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Operations and Services
Performance, NWSPD 10-16

STORM DATA PREPARATION

NOTICE: This publication is available at: http://www.nws.noaa.gov/directives/.

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SUMMARY OF REVISIONS: This directive supersedes National Weather Service Instruction (NWSI) 10-1605, dated August 26, 2004.

The following changes were made:

- Definitions were changed to more closely match those in other directives. In addition, updates were made to the following event descriptions and instructions: Tsunami, Drought, Flash Flood, Flood, Thunderstorm Wind, Marine Thunderstorm Wind, Lightning, Excessive Heat, Strong Wind, Storm Surge/Tide, Tornado, and Wildfire.
- Direct death locations were clarified in several sections.
- New event categories were introduced: Coastal Flood, Cold/Wind Chill, Dense Smoke, Freezing Fog, Heat, Lakeshore Flood, Lake-Effect Snow, Marine High Wind, and Marine Strong Wind.
- The following event categories were renamed: Winter Weather/Mix event was changed to Winter Weather, Sleet Storm was changed to Sleet, and Storm Surge was changed to Storm Surge/Tide.
- The event category, Astronomical High Tide, was deleted. Those events will fall under the new category of Coastal Flood.
- Heat index tables and a wind chill table were added.
- Damage section includes a recommendation to develop County Warning Forecast Area (CWFA)-specific table of damage estimates.
- New examples were added to Excessive Heat, Drought, Storm Tide, Funnel Cloud, and Waterspout events.
- Resolution requirements for photos were introduced.

/signed/ 11/03/05
Dennis McCarthy Date
Director, Office of Climate, Water, and Weather Services

Storm Data Preparation

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1. *Storm Data* Disclaimer. *Storm Data* is an official publication of the National Oceanic and Atmospheric Administration (NOAA) which documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. In addition, it is a partial record of other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occurs in connection with another event.

Some information appearing in *Storm Data* may be provided by or gathered from sources outside the National Weather Service (NWS), such as the media, law enforcement and/or other government agencies, private companies, individuals, etc. An effort is made to use the best available information but because of time and resource constraints, information from these sources may be unverified by the NWS. Accordingly, the NWS does not guarantee the accuracy or validity of the information. Further, when information appearing in *Storm Data* originated from a source outside the NWS (frequently credit is provided), *Storm Data* users requiring additional information should contact that source directly. In most cases, NWS employees will not have the knowledge to respond to such requests. In cases of legal proceedings, Federal regulations generally prohibit NWS employees from appearing as witnesses in litigation not involving the United States.

1.1 Local Data Retention Requirements. All documentation used for the production of *Storm Data* will be retained for two years. Note: The National Climatic Data Center (NCDC) is the official custodian of NWS weather records and responds to requests for certified records for litigation purposes.

2. *Storm Data* Preparation. The *Storm Data* preparer should allocate a sufficient amount of preparation time to ensure that documentation and verification of significant weather phenomena are as accurate and complete as possible. The preparer should carefully coordinate the time and location of events that cross county warning and forecast areas (CWFA) to prevent inconsistencies in the *Storm Data* database. These quality control procedures are important, especially for events used in the NWS national verification program.

Preparation will be done using the currently authorized electronic method. Software methodology and hardware requirements are provided on the Office of Climate, Water, and Weather Services (OCWWS) Performance Branch internal StormDat/Verification Web site. Transmittal of the monthly report and upgrades to the software will be accomplished electronically. Inclusion of pictures in the monthly reports should be limited to unusual or highly significant events in order to keep *Storm Data* at a reasonable size. If pictures are not the property of NOAA, proper attribution should be provided.

2.1 Permitted Storm Data Events. The only events permitted in *Storm Data* are listed in Table 1 of Section 2.1.1. The chosen event name should be the one that most accurately describes the meteorological event leading to fatalities, injuries, damage, etc. However, significant events having no impact (all tornadoes or flash floods causing no damage, etc.) should also be included in *Storm Data*. See Section 7 for detailed examples. Additional details about record values of temperature, precipitation, etc., may be included in the narrative of an appropriate *Storm Data* event. However, only the more significant values should be summarized, such as monthly, seasonal, or yearly records. For example, a new monthly single-storm, snowfall record can be included in the narrative of a heavy snow event, or a new all-time, 4-hour rainfall record value can appear in the narrative of a flash flood event.

2.1.1 Storm Data Event Table

Event Name	**Designator**	**Event Name**	**Designator**
Astronomical Low Tide	Z	Ice Storm	Z
Avalanche	Z	Lake-Effect Snow	Z
Blizzard	Z	Lakeshore Flood	Z
Coastal Flood	Z	Landslide	Z
Cold/Wind Chill	Z	Lightning	C
Dense Fog	Z	Marine Hail	M
Dense Smoke	Z	Marine High Wind	M
Drought	Z	Marine Strong Wind	M
Dust Devil	C	Marine Thunderstorm Wind	M
Dust Storm	Z	Rip Current	Z
Excessive Heat	Z	Seiche	Z
Extreme Cold/Wind Chill	Z	Sleet	Z
Flash Flood	C	Storm Surge/Tide	Z
Flood	C	Strong Wind	Z
Frost/Freeze	Z	Thunderstorm Wind	C
Funnel Cloud	C	Tornado	C
Freezing Fog	Z	Tropical Depression	Z
Hail	C	Tropical Storm	Z
Heat	Z	Tsunami	Z
Heavy Rain	C	Volcanic Ash	Z
Heavy Snow	Z	Waterspout	M
High Surf	Z	Wildfire	Z
High Wind	Z	Winter Storm	Z
Hurricane (Typhoon)	Z	Winter Weather	Z

Legend: There are three designators: C - County/Parish; Z - Zone; and M - Marine. (Refer to Section 2.4 to find instructions on how to designate Alaska Region events.)

Table 1. *Storm Data* Event Table.

2.2 Aircraft/Marine Incidents. It is the responsibility of the National Transportation Safety Board (NTSB) to investigate and file reports on the probable causes of aviation and marine-related incidents. A *Storm Data* preparer, however, can include events that may have resulted in an incident in *Storm Data* as long as associated NWS operational performance is not discussed. See Funnel Cloud, Marine Thunderstorm Wind, and Seiche examples in Section 7.

2.3 Time. The beginning and ending time for each event will be entered as accurately as possible. Use local standard time in 24-hour clock throughout the year, such as 0600 Eastern Standard Time (EST), 0925 Central Standard Time (CST), 1800 Mountain Standard Time (MST), etc. Forecast offices having a CWFA responsibility in multiple-time zones should enter data in the appropriate time zone for the event's location.

Establishing the time of an event to the nearest minute will be difficult in certain situations. To minimize this problem, the *Storm Data* preparer should carefully compare all storm reports to available radar data, using unique radar signatures to make adjustments in the event time.

The *Storm Data* preparer must ensure that event times in the event header strip are consistent with event times mentioned in the narrative paragraph. Extra quality control is needed in order to minimize user confusion and ensure that the national severe weather database is as accurate as possible.

In general, the beginning time of an event, as it appears in the header-strip, is the time when the event reached locally, regionally, or nationally established advisory or warning criteria. The ending time of an event is when its meteorological characteristics cease to exist, weaken or diminish significantly, or there is no longer any hazard or impact on society. For example, for a heavy snow event, the beginning time is when warning criteria were first met, and the ending time is when accumulating snow ended. However, it is recommended to include the time snow first began accumulating in the narrative for additional information (likewise for other “accumulation” events).

2.3.1 Events That Span More Than One Month. Events that span more than one month will be entered for each month they occur. Directly-related fatalities, injuries, and damages will be given in the appropriate column for the month currently being prepared. Additional summary information on cumulative fatalities, injuries, or damages from previous months can be explained in the narrative portion of the *Storm Data* entry for the final month of the event.

2.4 Location. A hydro-meteorological event will be referenced to the particular village/city, airport, or inland lake, providing that the reference point is documented in the StormDat location database. The referenced location used in StormDat must be in the same county in which the event took place. Additional detailed information on the exact location of an event can be included in the narrative paragraph. This additional detailed information, such as highway names or numbers, city parks, and small lakes or other landmarks, would be useful when the event occurs within the boundaries of a large city. In some cases, if the event is relatively widespread, it may be referenced to geographical portions of a county/parish (e.g., northern portion or countywide/parish-wide).

For marine zones, a hydro-meteorological event will be referenced (azimuth and range) to the reference points documented in the StormDat location database.

In the NWS’s Alaska Region, all land-based events are reported by zone (Z), since counties do not exist in Alaska.

2.5 Event Source. The source of each *Storm Data* event will be entered in the software program. Possible sources of reports include “trained spotter,” “law enforcement,” and “emergency management.” In those cases where the source of the event report is not obvious, the preparer should use professional judgment as to what source is appropriate. Even though the event source does not appear in the final *Storm Data* publication, this information is used in related NWS statistical studies.

2.6 Fatalities/Injuries. The determination of direct versus indirect causes of weather-related fatalities or injuries is one of the most difficult aspects of *Storm Data* preparation. Determining whether a fatality or injury was direct or indirect has to be examined on a case-by-case basis. It is impossible to include all possible cases in this directive. The preparer should include the word “indirect” in all references to indirect fatalities or injuries in the narrative. This will minimize any potential confusion as to what fatalities and injuries referenced in the narrative were direct or indirect. A narrative example follows.

> “Powerful thunderstorm winds leveled trees and power lines in and around Morristown, TN. One of the toppled trees struck and killed two men running for shelter. During the clean-up operations after the storm, a person on an ATV was injured (indirect) when their vehicle struck a tree that blocked a road.”

Special care must be exercised when dealing with situations in which vehicles leave a road surface (due to a non-weather reason) not covered with flood waters and go into river/canals not above flood stage. Any fatalities, injuries, or damage in these cases will not be entered into *Storm Data*, since they are not weather-related.

2.6.1 Direct Fatalities/Injuries. A direct fatality or injury is defined as a fatality or injury directly attributable to the hydro-meteorological event itself, or impact by airborne/falling/ moving debris, i.e., missiles generated by wind, water, ice, lightning, tornado, etc. In these cases, the weather event was an “active” agent or generated debris became an active agent. Generalized examples of direct fatalities/injuries would include:

a. Thunderstorm wind gust causes a moving vehicle to roll over;

b. Blizzard winds topple a tree onto a person; and

c. Vehicle is parked on a road, adjacent to a dry arroyo. A flash flood comes down the arroyo and flips over the car. The driver drowns.

An injury should be reported on the header line if a person suffers a directly-related weather injury requiring treatment by a first responder or subsequent treatment at a medical facility. Injured persons who deny medical treatment also may be included. Persons who are not considered injured but who are affected by the phenomenon may be discussed in the narrative.

Fatalities and injuries directly caused by the weather event will be entered in the StormDat software “fatality” and “injury” entry tables, respectively. For direct fatalities, enter the specific data as queried by the software, i.e., number of individuals, age, sex, location, etc. Obtain information from reliable sources. The alphanumeric fatality code trailing the narrative is automatically inserted by the software. See Section 7 for detailed examples.

2.6.1.1 Specifying Direct Fatality Locations. When specifying the location of the direct Fatality, only the choices found in Table 2 of Section 2.6.1.2 are to be used. In some cases, it will be easy to establish the fatality location, and in others it will be difficult, especially with water situations. For example, a person drives their vehicle into a flash flood; their vehicle is overturned, and they drown. In this situation, you should choose the "Vehicle and/or Towed Trailer" location (VE), since the person died as a result of being in the vehicle floodwaters.

2.1.6.2 Direct Fatality Location Table.

BF	Ball Field	MH	Mobile/Trailer Home
BO	Boating	OT	Other
BU	Business	OU	Outside/Open Areas
CA	Camping	PH	Permanent Home
CH	Church	PS	Permanent Structure
EQ	Heavy Equip/Construction	SC	School
GF	Golfing	TE	Telephone
IW	In Water	UT	Under Tree
LS	Long Span Roof	VE	Vehicle and/or Towed Trailer

Table 2. Direct Fatality Location Table.

2.6.2 Indirect Fatalities/Injuries. Fatalities and injuries, occurring in the vicinity of a hydro-meteorological event, or after it has ended, but not directly caused by impact or debris from the event (weather event is a passive entity), are classified as indirect. Any available indirect fatalities and injuries should be discussed in the narrative paragraph, but will not be entered in the software "fatality" or "injury" entry tables. Indirect fatalities/injuries will not be tallied in official *Storm Data* statistics.

Fatalities and injuries due to motor vehicle accidents on slippery, rain, or ice covered roads are indirect. Ice, snow, and water on road surfaces are "passive" agents that do not directly impact a person or property, even though they induce conditions that trigger another event causing a fatality or injury.

If the hydro-meteorological event induced conditions that triggered another event resulting in the fatality/injury, then it is indirect. For example, heart attacks, resulting from overexertion during or following winter storms, electrocution caused by contact with a downed power line after a storm has ended, a death occurring during post-storm cleanup operations, or a death in a fire triggered by lightning are indirect.

Fatalities and injuries resulting from driving into dense fog or a blinding blizzard or dust/sandstorm are indirect. Generalized examples of indirect fatalities/injuries follow (see Section 7 for detailed examples).

a. Dense fog reduces visibilities from zero to 1/8 mile. A 20-vehicle pile-up occurs;

b. Thunderstorm winds topple trees onto a road. A motorist runs into a tree 30 minutes after the storm occurred;

c. Heavy snow is in progress and roads become icy/snow-covered. A vehicle slides across the road into another vehicle;

d. Lightning starts a fire which destroys a home, killing its occupants; and

e. People suffer carbon monoxide poisoning due to improper or inadequate venting of heating systems, portable heaters, generators, etc.

2.6.3 Delayed Fatalities. On occasion, a fatality will occur a few days after the end of a meteorological event, due to weather-related injuries or the effects of the event. This is most common with long-duration, excessive heat episodes in which individuals never recover from the initial effects of the heat wave. The *Storm Data* preparer has two methods to include these fatalities.

a. Enter the post-event fatality information as part of the meteorological event that just ended, but enter the actual date of delayed fatality in the fatality entry table. This is the preferred method. An explanation can be given in the narrative; or

b. Enter the post-event fatality information as part of a new meteorological event, if appropriate. An explanation can be given in the narrative.

2.7 Damage. Property damage estimates should be entered as actual dollar amounts, if a reasonably accurate estimate from an insurance company or other qualified individual is available. If this estimate is not available, then the preparer has two choices: either do not make damage entries, or make an estimate. The exception is for flood events. The *Storm Data* preparer must enter monetary damage amounts for flood events, even if it is a “guesstimate.” The U.S. Army Corps of Engineers requires the NWS to provide monetary damage amounts (property and/or crop) resulting from any flood event.

The *Storm Data* preparer is encouraged to make a good faith attempt to obtain or estimate the damage. Property damage estimates are very important for many users and should be obtained if at all possible.

Estimates can be obtained from emergency managers, U.S. Geological Survey, U.S. Army Corps of Engineers, power utility companies, and newspaper articles. If the estimates provided are rough guesses, then this should be stated as such in the narrative. Estimates should be rounded to three significant digits, followed by an alphabetical character signifying the magnitude of the number, i.e., 1.55B for $1,550,000,000. Alphabetical characters used to signify magnitude include “K” for thousands, “M” for millions, “B” for billions, and “T” for trillions. If additional precision is available, it may be provided in the narrative part of the entry. When damage is due to more than one element of the storm, indicate, when possible, the amount of damage caused by each element. If the dollar amount of damage is unknown, or not available, leave the entry blank.

Typically, damage refers to damage inflicted to private property (structures, objects, vegetation) as well as public infrastructure and facilities. Specific breakdowns should be stated in the textual narrative (refer to Section 2.9), if possible. The number of structures with minor or moderate damage should be indicated, as well as the number of buildings destroyed.

In order to determine if the damage is directly related or indirectly related to the hydro-meteorological event, the *Storm Data* preparer will use the same guidelines for fatalities and injuries provided in Section 2.6.

It is suggested that the *Storm Data* preparer, in conjunction with emergency managers, insurance adjusters, utility company representatives, and the U.S. Army Corps of Engineers, develop a CWFA-specific table of typical damage estimates for replacing siding or roofs on homes, replacing windows and garages, installing new power poles and transmission wires, replacing barns and pole sheds, and repairing road washouts or building new bridges. This table would allow the preparer to estimate damage amounts when timely communication is not possible with emergency managers or insurance adjusters just prior to *Storm Data* submission.

2.7.1 Flood-Related Damage. Each WFO will report flood damage in their CWFA. The Service Hydrologist should assist in the collection and assessment of flood/flash flood information that pertains to *Storm Data*.

2.7.2 Crop Damage Data. Crop damage information may be obtained from reliable sources, such as the U.S. Department of Agriculture (USDA), the county/parish agricultural extension agent, the state department of agriculture, crop insurance agencies, or any other reliable authority. Crop damage amounts may be obtained from the USDA or other similar agencies.

2.7.3 Other Related Costs. The cost of such items as snow removal, debris clearing/moving, fire fighting, personnel overtime charges, public housing assistance, etc., will not be tallied as directly-related parts of the storm/crop damage. If “other related” cost estimates are available, they may be included in the narrative as a separate item (“for information only”), and stated as such.

2.7.4 Delayed Damage. On occasion, vegetative or structural damage will occur within a few days, or even a couple weeks, after a meteorological event. This is most common after a very heavy snowfall, or very heavy rain due to weight loading on roofs or buildings, tree branches, or power lines. Windy conditions after a heavy snow or heavy rain event may amplify the damage. In these cases, the *Storm Data* preparer has two methods to include this damage.

a. Enter the post-event damage information as part of the hydro-meteorological event that just ended and explain the situation in the narrative; or

b. Enter the post-event damage information as part of a new hydro-meteorological event, if appropriate, and explain the situation in the narrative.

2.8 Character of Storm. Enter the type of storm or phenomena in accordance with the look-up table provided in the software. If known, maximum gusts will be encoded as "measured;" otherwise, they will be an estimate (gusts are given in knots). Hail size will be given in hundredths of an inch (0.50, 0.75, 0.88, 1.00, 1.50, etc., are the most common). Data regarding multiple severe phenomena (events) within a single episode will be provided as separate entries.

2.9 Textual Description of Storm (Narrative). Only the more complex events require narratives. For example, lightning strikes or hail occurrences, as a single phenomenon, should not necessitate narratives unless they are part of a more complex weather event or cause a fatality/injury or significant damage. The narrative should expand on the information in the quantitative data, especially casualties. For lightning fatalities or injuries, include weather conditions at the time of occurrence, if known or determinable. Include times, locations, and destruction of trees, crops, power lines, roads, bridges, etc. Storm characteristics, such as the intermittence of tornado paths, may be included.

A single narrative may be used to describe the multiple severe phenomena (events) within a single severe weather episode. A separate narrative will be composed for every tornado event.

Additional remarks (or an electronically inserted picture) may serve to locate storms more precisely and may give the aerial extent and the directional movement or speed. Such additional detail should be prepared as support documentation to Outstanding Storms of the Month (see Section 4, Outstanding/Unusual Storms of the Month [OSM].

The narrative should be concise and not repeat information provided in the quantitative data. When used properly, the narrative integrates the numerical data into a cohesive meteorological event.

When writing the narrative, always indicate when and where tornadoes and thunderstorm wind events cross county, parish, and state lines, and boundaries of WFO CWFA responsibility. *Storm Data* preparers will coordinate with other affected offices to determine time and location of border-crossing tornadoes or other events.

2.10 Pictures. Inclusion of electronic images (.jpg only) into the monthly reports should be limited to unusual or highly significant events in order to minimize the size of the *Storm Data* publication.

3. Disposition of *Storm Data*. *Storm Data* files will be transferred electronically to the Performance Branch (W/OS52), using the currently authorized software, no later than 60 days after the end of the month for which the data is valid. Negative reports are required, and simply require one to transmit a "blank" month in compressed format (no entries or text needed, just type in beginning and ending dates). Additional related reports may be needed prior to, or after, 60 days after the end of the month for which the data is valid, depending on local, regional, or national requirements. The *Storm Data* preparer will refer to appropriate directives, and their MIC, for preparation instructions and distribution requirements.

4. Outstanding/Unusual Storms of the Month (OSM). A very important feature of the publication *Storm Data* is the OSM section. The OSM may be any type of event (tornadoes, hurricanes, snow, ice, hail, meso-systems, etc.). Events may be selected for this section for their meteorological significance or uniqueness, even if damage or casualties are minimal. Tornadoes of F4 intensity or greater should be submitted for the OSM. Otherwise, providing information for the OSM is optional but highly desirable. Good OSM material makes *Storm Data* more interesting and ultimately a more desirable product for users, thus assuring wider distribution of the monthly *Storm Data* input received from WFOs.

Although the Warning Coordination Meteorologist or *Storm Data* focal-point prepares the OSM, the Meteorologist-in-Charge (MIC) is ultimately responsible for OSM contributions from the field office. This includes all forensic discovery (data gathering, fact finding, development of statistics, etc.), drafting graphics and tables, supplying photographs, and preparing the narrative.

4.1 Requirements for Outstanding/Unusual Storms of the Month. The OSM material is used to enhance the cover appearance of the *Storm Data* publication, as well as provide additional detail not found in a documented event.

4.1.1 Text Format. The OSM should be prepared using any American Standard Code for Information Interchange (ASCII)-based software (Microsoft Word, Wordpad or Notepad).

4.1.2 Disposition Dates. The NCDC should be contacted within 30 days following the end of the month in which the event occurred, if a WFO wishes to have material considered for the OSM. All OSM material will be submitted to NCDC within 60 days following the end of the month in which the event occurred. OSM material submitted beyond 60 days will not be considered.

4.1.3 Copyrights. Permission or credit for the use of each item must be obtained from the original source before mailing or E-mailing to NCDC. Make sure that the submitted materials are accompanied by a description and name of photographer.

4.1.4 Final Editing. The NCDC will be responsible for final editing of the narrative and any necessary assembly of multiple OSM products. In addition, NCDC may produce additional OSM features.

4.1.5 Write-up/Discussion. The OSM will include a one or two-page write-up which incorporates the following: synoptic discussion of events leading up to the event, any warnings and watches in effect at the time of the event, any other notable information about the storm, storm statistics: (F-scale, hail size, wind gusts, snow amounts, etc.) and aftermath (fatalities, injuries, damage).

4.1.6 Pictures. Photographs, charts, or maps of the storm or the damage/aftermath should conform to the following guidelines:

a. Hand drawn or computer generated maps may be sent to depict damage amounts and/or location;

b. 35 mm photographs (or slides), images, maps, or charts may be sent via mail to NCDC, scanned and returned to sender;

c. 35 mm photographs (or slides), images, maps, or charts may be scanned by sender and sent via E-mail or FTP to NCDC;

d. Scan at original size;

e. Scan at 300 dpi or greater (dots per inch);

f. Save as .tif (preferred) or .jpg format;

g. Digital camera images may be used if they are taken on a good quality digital camera. Images submitted should have a 1600x 1200 or greater resolution, or 300 or greater dpi. Cover picture photographs should be of the highest quality. Please send original photograph and not a post production photograph as the quality may be compromised.

5. Tornado and Severe Thunderstorm Confirmation Reports. Four alphanumeric text products are produced by the Storm Prediction Center (SPC). These text products, referenced below in Table 3, summarize unofficial (preliminary) tornado and severe thunderstorm reports that were processed at SPC and originated from each WFO. Each WFO should compare the appropriate message with its local records. Any change in event information should be noted, but corrections will be made via *Storm Data*. Additional severe weather statistics and graphics can be found on the SPC Web page: http://www.spc.noaa.gov.

5.1 Table of SPC Statistical Messages .

AWIPS ID	WMO Comms Header	Product Description
MKCSTADTS	NWUS20 KWNS	Listing of tornado and severe thunderstorm from 6 AM CST the previous day to 6 AM CST on the current day
MKCSTAHRY	NWUS22 KWNS	Listing of tornado and severe thunderstorm reports from 6 AM CST on the current day, and updated on an hourly accumulative basis
MKCSTAMTS	NWUS21 KWNS	Statistics for tornado totals, tornado-related fatalities, and number of killer tornadoes on a monthly and yearly basis (current year and previous 3 years)
MKCSTATIJ	NWUS23 KWNS	Listing of killer tornadoes for current year

Table 3. SPC Tornado and Severe Thunderstorm Statistical Report Table.

6. Weekly Warning Reports. A weekly listing of all short-fuse severe weather warnings, categorized by WFO, is posted on the StormDat/Verification Web site. A *Storm Data* preparer should note any discrepancies in this report, and E-mail or fax copies of warning/text changes to W/OS52 as soon as possible. Photocopies will suffice.

7. Event Types. This section provides guidelines for entering event types in StormDat (*StormData*).

7.1 **Astronomical Low Tide (Z).** Abnormal, or extremely low tide levels, that result in deaths or injuries, or watercraft damage (significant economic impact) due to low water levels. Astronomical low tides are made more extreme when strong winds produce a considerable seaward transport of water, resulting in previously submerged, non-hazardous objects become hazardous or exposed.

Beginning Time - When the low tide began to cause damage.

Ending Time - When tides returned to normal.

Direct Fatalities/Injuries
- ❑ A boat traversing an ocean inlet foundered on the rocks in the unusually low waters and the boaters drown.

Indirect Fatalities/Injuries
- ❑ A sightseer was killed when he drove off the road while looking at the absence of water.

Example:

AKZ203-204 Eastern Beaufort Sea Coast - Central Beaufort Sea Coast
24 0100AST 0 0 Astronomical Low Tide
25 2300AST
A moderate pressure gradient developed over the Arctic coast on the 23rd and persisted until the 26th, with east winds ranging from 25 to 45 kts (28 to 52 mph) on the 24th and 25th. The sea ice edge was 20 miles offshore and the wind produced a considerable seaward transport of water, causing the water level in Prudhoe Bay to run several feet below normal. Normal tidal variations are only one foot or less along the Beaufort Sea coastline. Extensive marine operations were halted at Prudhoe Bay during this time, including the unloading of barges.

7.2 **Avalanche (Z).** A mass of snow, sometimes containing rocks, ice, trees, or other debris, that moves rapidly down a steep slope, resulting in a fatality, injury, or significant damage. If a search team inadvertently starts another avalanche, it will be entered as a new Avalanche event.

Beginning Time - When the snow mass started to descend.

Ending Time - When the snow mass ceased motion.

Direct Fatalities/Injuries
- ❏ People struck by the snow mass or any debris contained within.
- ❏ People struck by debris tossed clear of the avalanche.
- ❏ People buried by the avalanche.

Indirect Fatalities/Injuries
- ❏ People who ran into (in a motor vehicle, on skis, etc.) the snow mass or debris *after* it stopped moving.

Example:

COZ012 West Elk and Sawatch Mountains/Taylor Park
06 1900MST 5 1 Avalanche
1915MST
Four college students were caught in an avalanche, triggered when one of the students crossed a slope just below the summit on Cumberland Pass, which is about 25 miles east-northeast of Gunnison in the Sawatch Mountain Range. The entire slope at the 12,000-foot elevation fractured 6-feet deep and 1500 feet across and ran 400 vertical feet, with the resulting avalanche scouring the slope all the way to the 9,000-foot level. The skier who triggered the avalanche was buried next to a tree which provided an air space that was crucial to his survival. The other three students, including a snow-mobiler, a snow-boarder, and another skier, perished in the snow. The avalanche also destroyed a cabin, killing the occupant. Boulders dislodged by the avalanche, struck a car, killing the driver. M19OU, M20OU, M22OU, M43PH, F37VE

7.3 **Blizzard (Z).** A winter storm which produces the following conditions for 3 hours or longer: (1) sustained winds or frequent gusts 30 knots (35 mph) or greater, and (2) falling and/or blowing snow reducing visibility frequently to less than 1/4 mile.

Beginning Time - When blizzard conditions began.

Ending Time - When blizzard conditions ended.

(In *Storm Data*, no blizzard should cover a time period of less than 3 hours. If blizzard-like conditions occur for less than 3 hours, the event should be entered as Winter Storm, Heavy Snow, or Winter Weather, perhaps noting in the narrative that near-blizzard or blizzard-like conditions were observed at the height of the storm.)

Direct Fatalities/Injuries
- ❏ People who became trapped or disoriented in a blizzard and suffered/died from hypothermia.
- ❏ People who were struck by objects borne or toppled in blizzard wind.
- ❏ People suffered/died from a roof collapse due to the weight of heavy snow.

- ❑ A vehicle stalled in a blizzard. The occupant suffered from/died of hypothermia.

Indirect Fatalities/Injuries

- ❑ Vehicle accidents caused by poor visibility and/or slippery roads.

Example:

MIZ049-055 Huron - Sanilac
02 2200EST 2 0 Blizzard
03 0300EST
A massive low pressure system moving up the East Coast brought very cold air south across the Great Lakes. This produced an unusually active lake effect snow event in the Thumb area. Aided by sustained north winds of 35 to 43 knots (40 to 50 mph), with gusts to 56 knots (65 mph), the snow and blowing snow reduced visibilities to near zero across much of Huron and Sanilac Counties. Snow accumulations were very difficult to measure due to the high winds, but were commonly cited in the 12- to 17-inch range. Up to 10-foot snow drifts were observed. Most of the area was essentially shut down for the next 3 days. Two people in Huron County froze to death after they left their snow-covered vehicle and attempted to walk to a nearby farm home. M55OU, F60OU

7.4 **Coastal Flood (Z).** Flooding of coastal areas due to the vertical rise above normal water level caused by strong, persistent onshore wind, high astronomical tide, and/or low atmospheric pressure, resulting in damage, erosion, flooding, fatalities, or injuries. Coastal areas are defined as those portions of coastal land zones (coastal county/parish) adjacent to the waters and bays of the oceans. Farther inland, the *Storm Data* preparer must determine when and where to encode a flood event as Flash Flood or Flood. Terrain (elevation) features will determine how far inland the coastal flooding extends.

Note: Flooding of lakeshore areas (e.g., Great Lakes, Lake Okeechobee, and Lake Pontchartrain) should be entered under the Lakeshore Flood event category.

If the astronomical tide height for the flooded area is known, it should be subtracted from the total water level/storm tide (runup/debris line), and the result specifically labeled in the narrative as “storm surge.” The method of measuring surge height should be mentioned in the narrative, e.g. “NWS survey team calculated a surge height of 4 feet by subtracting the astronomical tide height from the runup/debris line height.” **For Storm Data, coastal flood events that are associated with a storm of tropical origin (e.g., hurricane, typhoon, or tropical storm) should be reported under the Storm Surge/Tide event category; all other coastal flooding events should be reported here.**

Beginning Time - When the water level began to cause damage or flooding.

Ending Time - When the water level dropped to a point where damage or flooding ended.

Direct Fatalities/Injuries

- ❑ A coastal dwelling was washed away injuring/killing the occupants.
- ❑ A person drowned when a vehicle was swept away by the storm surge/tide.

Indirect Fatalities/Injuries

- ❑ A person suffered a heart attack while evacuating from a storm tide.
- ❑ A person died in a vehicle accident caused by the storm tide washing away a traffic signal.
- ❑ A person died in a vehicle accident after losing control in standing water on a road.

Example:

ORZ022 **Curry County Coast**
07 0600PST 0 0 100K Coastal Flood
1000PST
A large slow-moving low pressure area off the northwest U.S. coast caused a 4-foot storm tide, as reported by local police, to a portion of the Oregon coast. The storm tide washed away part of Port Orford's sewage treatment plant.

7.5 **Cold/Wind Chill (Z).** Period of low temperatures or wind chill temperatures reaching or exceeding locally/regionally defined advisory (typical value is -18^0F or colder) conditions. There can be situations where advisory criteria are not met, but the combination of cold temperatures and low wind chill values result in a fatality. In these situations, a cold/wind chill event may be documented if the weather conditions were the primary cause of death as determined by a medical examiner. Normally, cold/wind chill conditions should cause human and/or economic impact.

Beginning Time - When cold temperatures or wind chill equivalent temperatures began.

Ending Time - When cold temperatures or wind chill equivalent temperatures ended.

Direct Fatalities/Injuries

- ❑ A fatality where hypothermia was ruled as the primary, or major contributing factor as determined by a medical examiner or coroner. If other weather factors, such as freezing/frozen precipitation, disorient the person, trap the person, or cause the person to collapse, but cause of fatality was exposure or hypothermia, the fatality may be entered under the event type Winter Storm, Winter Weather, etc. The *Storm Data* preparer must use sound judgment and work with the local medical examiner or coroner.
- ❑ Elderly person wandered away from a nursing home, became disoriented, and froze. Medical examiner ruled that the major cause of death was hypothermia.
- ❑ Cases in which people receive medical treatment for frostbite or cold-hypothermia can be considered a direct injury.

Indirect Fatalities/Injuries

- ❑ Cases where people suffer carbon monoxide poisoning from using an improperly ventilated fuel burning portable heater due to the cold.
- ❑ Cases where people are injured or killed in a house fire due to improper use of portable heaters due to the cold.

Example:

WIZ001>004 Ashland – Bayfield – Douglas - Iron
05 0600CST 2 0 0 0 Cold/Wind Chill
07 1200CST
Cold arctic air pushed into northwestern Wisconsin behind a strong cold front. Wind chill values dropped to -18 to -30 as northwest winds blew at 20 to 30 mph. Two cross-country skiers died from exposure on a trail west of Hurley in Iron County. The medical examiner classified the fatalities as being due to cold-hypothermia. M32OU, F33OU

INZ001 Lake
11 2000CST 1 0 Cold/Wind Chill
12 1400CST
A homeless man was found dead in Gary, Indiana. The cause of death was hypothermia. It was raining on this cold October day with winds of 17 to 26 knots (20 to 30 mph) and temperatures in the 30s. M42OU

7.6 **Dense Fog (Z).** Water droplets suspended in the air at the Earth's surface over a widespread or localized area reducing visibility to values equal to or below locally/regionally established values for dense fog (usually 1/4 mile or less) and impacting transportation or commerce.

Beginning Time – When dense fog criteria were first met.

Ending Time – When dense fog criteria were no longer met.

Direct Fatalities/Injuries – None.

Indirect Fatalities/Injuries
- ❑ Fatalities and injuries resulting from vehicular accidents caused by dense fog.
- ❑ During extremely dense fog, a construction worker lifted a metal pipe which touched a power line, resulting in electrocution.

Example:

NCZ053-065 Buncombe - Henderson
30 0400EST 0 0 Dense Fog
1000EST
Dense fog developed in the early morning hours in the French Broad River valley. The fog played havoc with the morning commute, and contributed to

several accidents in and south of Asheville. At 0900 EST, the fog contributed to a 25-car pile-up on Interstate 40 on the south side of Asheville. The accident claimed 4 lives (indirect fatalities) and injured 17 (indirect). Asheville Regional Airport was closed for most of the morning. The North Carolina State Police shut down Interstate 26 between the airport and the city as a precautionary measure.

7.7 **Dense Smoke (Z).** Widespread or localized dense smoke, reducing visibilities to values equal to or below locally/regionally established values (usually ¼ mile or less), that adversely affects people and/or impacts transportation or commerce. Dense smoke in various concentrations suspended in the air at the Earth's surface can cause problems for people with heart or respiratory ailments.

Beginning Time - When dense smoke criteria were first met.

Ending Time - When dense smoke criteria were no longer met.

Direct Fatalities/Injuries

❑ People who suffered/died from inhalation of dense smoke.

Indirect Fatalities/Injuries

❑ Fatalities and injuries resulting from vehicular accidents caused by dense smoke.

Example:

MTZ0005 Missoula/Bitterroot Valleys
31 0400MST 2 0 Dense Smoke
1000MST
Dense smoke developed in the early morning hours in the Missoula and Bitterroot Valleys from a combination of surrounding forest fires in the Bitterroot Mountains and a strong low level inversion. The dense smoke played havoc with the morning commute, and contributed to several long delays from minor accidents on Highway 93 near Lolo. Two elderly people died after being hospitalized for smoke inhalation near Florence. Dense smoke also delayed morning flights for several hours at Missoula International Airport. M88OU, F92OU

7.8 **Drought (Z).** Drought is a deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area. Conceptually, drought is a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield. There are different kinds of drought: meteorological, agricultural, hydrological, and social-economic. Each kind of drought starts and ends at different times. Additional information can be obtained at this web address: http://drought.unl.edu/whatis/concept.htm.

A drought event should be included in *Storm Data* when the intensity of the moisture deficiency and other factors result in a D2 classification, or higher, as indicated in the Drought Monitor, a multi-agency effort. Details can be found at this web address: http://drought.unl.edu/dm/monitor.html.

Droughts are rated as D0, D1, D2, D3, or D4. This information should be included in the narrative.

Beginning Time - When an area first reaches D2 classification (severe drought).

Ending Time - When an area is no longer in at least a D2 classification.

Direct Fatalities/Injuries
- ❏ Extremely rare.

Indirect Fatalities/Injuries
- ❏ None.

Example:

MTZ003 **Flathead/Mission Valleys**

01 0000MST 0 0 55K Drought
22 1800MST

A drought, which began in early July ended for much of the Flathead and Mission Valleys on September 22, when 3 to 5 inches of precipitation fell. For many locations this was the first significant rain of over a quarter of an inch since July 4. The drought's effect was especially felt during the first 3 weeks of September (D3) after numerous grass fires prompted many communities to ban any type of outdoor burning. Among the largest fires reported were: 180-200 acres of grassland and timber from Pablo to St. Ignatius. The most costly reported fire was when smoldering leaves ignited dry grass near Ronan, eventually spreading into two homes and causing $55,000 worth of damage. Damage amounts do not include costs to individual fire departments for fire containment.

Note: This example above should have entries in July and August *Storm Data* as well. Damage amounts in the header are for the current month only. Grand totals for the entire drought episode should be mentioned in the narrative. In some cases the effects and cost of a drought may not be known for some time.

7.9 **Dust Devil (C).** A ground-based, rotating column of air, not in contact with a cloud base, usually of short duration, rendered visible by dust, sand, or other debris picked up from the ground, resulting in a fatality, injury, or damage. Dust devils usually result from intense, localized heating interacting with the micro-scale wind field. Dust devils that do not produce a fatality, injury, or significant damage may be entered as an event if they are unusually large, noteworthy, or create strong public interest.

Beginning Time - When the rotating column of air first became visible.

Ending Time - When the rotating column of air was no longer visible.

Direct Fatalities/Injuries

- ❑ People who were asphyxiated due to high dust/sand content in the air. (Rare)
- ❑ People who were hit by flying debris.
- ❑ Vehicle was tipped over or blown off a road.

Indirect Fatalities/Injuries

- ❑ Vehicular accidents caused by reduced visibility during a dust devil, or vehicular accidents caused by debris left on a road after a dust devil passed by.

Example:

Maricopa County

4 W Gila Bend	**12**	**1400MST**	**0**	**2**	**Dust Devil**
		1420MST			

A sunny, hot day caused many dust devils to form. One became quite strong and moved directly along Interstate 8, according to amateur radio reports. Visibility was severely reduced in the dust devil. One motorist drove into the dust devil, which pushed and flipped the vehicle off the road. The driver and one passenger were injured. Winds were estimated at 56 knots (65 mph).

7.10 **Dust Storm (Z).** Strong winds over dry ground, with little or no vegetation, that lift particles of dust or sand, reducing visibility over a localized or widespread area below regionally/locally established values (usually 1/4 mile or less), and results in a fatality, injury, damage, or major disruption of transportation.

Beginning Time - When an area of blowing dust or sand first reduced visibility to regionally/locally established values or began to cause a major impact.

Ending Time - When an area of blowing dust or sand diminished so that visibility was above regionally/locally established values or no longer had a major impact.

Direct Fatalities/Injuries

- ❑ People who were asphyxiated due to high dust/sand content in the air. (Rare)
- ❑ People who were hit by flying debris.
- ❑ Vehicle tipped/pushed over or blown off a road by the strong winds, resulting in an accident and associated fatalities/injuries.

Indirect Fatalities/Injuries

- ❑ Vehicular accidents caused by reduced visibility during a dust storm or by debris left on a road after a dust storm passed.

Example:

KSZ061 Hamilton
24 1600MST 0 2 20K Dust Storm
1645MST
A strong cold front caused wind gusts to around 43 knots (50 mph) across far western Kansas. An area of dust and dirt was lifted hundreds of feet into the air, reducing the visibility to near zero across U.S. Highway 50, west of Syracuse. A wind gust overturned and damaged an empty semi-trailer, injuring the two occupants.

7.11 **Excessive Heat (Z).** Excessive Heat results from a combination of high temperatures (well above normal) and high humidity. An excessive heat event occurs and is reported in *Storm Data* whenever heat index values meet or exceed locally/regionally established excessive heat warning thresholds. Fatalities (directly-related) or major impacts to human health occurring during excessive heat warning conditions are reported using this event category.

Fatalities or impacts to human health occurring when conditions are below excessive heat criteria are reported within the Heat event category. In some heat waves, fatalities occur up to three days following the meteorological end of the event. The preparer should include these fatalities in the event, but encode the actual date of the directly related fatalities in the fatality entry table.

Depending on the part of the country experiencing high temperatures, the heat effects are modulated by relative humidity, cloud cover, wind speeds, the duration of a hot spell, the time of the year, and other factors, including mortality rates and types of housing.

Beginning Time - When local thresholds for excessive heat were first met or when abnormally hot conditions began.

Ending Time - When local thresholds for excessive heat were no longer met or abnormally hot conditions ended.

Direct Fatalities/Injuries

- ❏ Fatality where heat-related illness or heat stress was the primary, or major contributing factor as determined by a medical examiner or coroner.
- ❏ An elderly person suffered heat stroke and died inside a stuffy apartment during a heat wave.
- ❏ A toddler was left inside a car while a parent went inside a grocery store on a hot day where ambient conditions met the local definition of excessive heat. The windows were left rolled up, and the toddler died. Likewise, any person or group of persons who die as a result of being trapped inside a vehicle or other enclosure during excessive heat conditions, would be labeled as direct fatalities.
- ❏ Cases in which people receive medical treatment for heat-hyperthermia (severe dehydration, sunstroke, heatstroke, etc.) and survive are considered injuries, not illnesses, for Storm Data purposes.

Indirect Fatalities/Injuries

- ❑ Fatality where excessive heat was the secondary, or contributing factor.
- ❑ Excessive heat triggers widespread power outages, which in turn cause a person's respirator to turn off, and that person dies.

Examples:

MIZ068>070-075-Livingston - Oakland - Macomb - Washtenaw - Wayne - Lenawee -
-075-076-082-083 Monroe

02 1300EST 4 24 Excessive Heat
05 2000EST

Very hot and humid weather moved into southeast Michigan just in time for the Fourth of July weekend. High temperatures were in the middle to upper 90s across metro Detroit all 4 days, with Detroit City Airport reaching 100 degrees on July 4. The high of 97 degrees at Detroit Metropolitan Airport on July 5 set a new record for that date. Heat indices were in the 105 to 115-degree range all four afternoons. Dozens of people were treated at area hospitals for heat-related illnesses over the weekend, and four elderly people died from heat stroke based on medical reports. Two of the fatalities occurred on July 4, one on July 5, and one person died on July 7 after being hospitalized for heat stroke for 2 days. The heat wave finally broke when a cold front moved through Lower Michigan late in the day on July 5. M89PH, F77PH, M95PH, F72PH

MOZ037 Jackson

10 1800CST 1 0 Excessive Heat
11 2000CST

The high temperature reached 105 degrees with a heat index of 115 on the afternoon of June 11. During the overnight hour of June 10th the heat indices stayed above 85. The medical examiner reported an elderly woman died from heat stress. She was found dead in her apartment. F84PH

NYZ071>077 Southern Westchester – New York (Manhattan) – Bronx – Richmond (Staten Island) – Kings – (Brooklyn) – Queens – Nassau-

13 1300 EST 0 0 Excessive Heat
14 2200 EST

Temperatures topped out around 100 degrees in New York City during the afternoon hours of the 13th and 14th, with a maximum heat index around 115 degrees both days. No reports of fatalities or injuries were received due to excellent Emergency Management response, but excessive heat criteria were met.

7.11.1 Heat Index Table.

HEAT INDEX VALUES											
	RELATIVE HUMIDITY (%)										
T(F)	20	30	35	40	45	50	55	60	70	80	90
75	71	72	73	73	74	74	75	75	76	77	80
80	77	79	79	80	81	81	82	83	84	86	88
85	82	84	85	86	87	88	89	90	93	97	101
90	87	89	91	93	95	96	98	100	106	112	119
95	92	96	98	101	104	107	110	114	122	131	142
100	99	104	107	110	115	120	126	130	141	154	
105	105	113	118	123	129	135	142	148	163		
110	112	123	130	137	143	150	158	166			
115	120	135	143	151	158	166	178				
120	130	148	157	166	174	182					
125	141	162	173	182	190						
130	153	177	190	199							

HEAT INDEX VALUES											
	DEWPOINTS (F)										
T(F)	35	40	45	50	55	60	65	70	75	80	85
75	74	75	79	77	77	78	78	79	80		
80	77	78	78	79	80	81	82	84	86	90	
85	81	81	82	83	84	86	87	90	93	98	106
90	85	85	86	87	89	91	93	96	101	107	115
95	89	90	91	92	94	96	99	103	108	115	124
100	94	95	96	98	100	102	105	109	115	122	132
105	99	100	101	103	105	107	111	116	122	129	139
110	104	105	107	108	111	113	117	121	128	136	146
115	109	110	111	113	116	118	123	128	134	141	153
120	113	114	117	119	121	124	128	133	139	148	158
125	117	119	121	123	126	129	134	139	145	153	164
130	121	122	126	127	131	135	139	143	149	159	169

Table 4. Heat Index Values Based on Relative Humidity or Dew Point.

7.12 **Extreme Cold/Wind Chill (Z).** A period of extremely low temperatures or wind chill temperatures reaching or exceeding locally defined warning criteria (typical value around -35^{0}F or colder). Normally these conditions should cause significant human and/or economic impact. However, if fatalities occur with cold temperatures/wind chills but extreme cold/wind chill criteria are not met, the event should also be included in *Storm Data* as a Cold/Wind Chill event and the fatalities are direct.

Beginning Time - When extreme or abnormally cold temperatures or wind chill equivalent temperatures began.

Ending Time - When extreme or abnormally cold temperatures or wind chill equivalent temperatures ended.

Direct Fatalities/Injuries

- A fatality where hypothermia was ruled as the primary, or major contributing factor as determined by a medical examiner or coroner. If other weather factors, such as freezing/frozen precipitation, disorient the person, trap the person, or cause the person to collapse, but cause of fatality was exposure or hypothermia, the fatality may be entered under the event type Winter Storm, Winter Weather, etc. The *Storm Data* preparer must use sound judgment and work with the local medical examiner or coroner.
- Elderly person wandered away from a nursing home, became disoriented, and froze. Medical examiner ruled that the major cause of death was hypothermia.
- Cases in which people receive medical treatment for frostbite or cold-hypothermia can be considered an injury.

Indirect Fatalities/Injuries

- After shoveling snow, a man collapsed in the driveway. The medical examiner determined the primary cause of fatality was heart attack.

Examples:

WYZ054>058 Gillette - South Campbell - Moorcroft - Wyoming Black Hills - Weston
01 1200MST 4 0 500K 50K Extreme Cold/Wind Chill
03 1000MST
Bitterly cold arctic air settled over parts of northeast Wyoming. Temperatures fell to 35 below to 45 below zero (-45 in Gillette) on the 2nd. Four fishermen were found frozen at their campsite near Pine Haven at Keyhole State Park in Crook County. The medical examiner classified the fatalities as being due to cold-hypothermia. The extreme cold caused water mains and pipes to freeze and burst in Gillette and Newcastle, resulting in water damage to homes and businesses. In addition, a couple of ranchers reported losses. M44OU, F42OU, F57OU, M59OU

NDZ050 McIntosh
15 1000CST 1 0 Extreme Cold/Wind Chill
15 2200CST
An 84-year-old Lehr man died of hypothermia when he went to visit the grave of his wife. The man was found 1 mile from his house. Temperatures that day were around 20 below and wind speeds of 17 to 22 knots (20-25 mph). Wind chills were estimated to be around 50 below. The man was not wearing a coat or gloves when he was found. M84OU

7.12.1 Wind Chill Table.

Wind Chill Chart

Wind (mph)

Temperature (ºF)

Calm	5	10	15	20	25	30	35	40	45	50	55	60
40	36	34	32	30	29	28	28	27	26	26	25	25
35	31	27	25	24	23	22	21	20	19	19	18	17
30	25	21	19	17	16	15	14	13	12	12	11	10
25	19	15	13	11	9	8	7	6	5	4	4	3
20	13	9	6	4	3	1	0	-1	-2	-3	-3	-4
15	7	3	0	-2	-4	-5	-7	-8	-9	-10	-11	-11
10	1	-4	-7	-9	-11	-12	-14	-15	-16	-17	-18	-19
5	-5	-10	-13	-15	-17	-19	-21	-22	-23	-24	-25	-26
0	-11	-16	-19	-22	-24	-26	-27	-29	-30	-31	-32	-33
-5	-16	-22	-26	-29	-31	-33	-34	-36	-37	-38	-39	-40
-10	-22	-28	-32	-35	-37	-39	-41	-43	-44	-45	-46	-48
-15	-28	-35	-39	-42	-44	-46	-48	-50	-51	-52	-54	-55
-20	-34	-41	-45	-48	-51	-53	-55	-57	-58	-60	-61	-62
-25	40	47	51	55	58	60	62	64	65	67	68	69
-30	-46	-53	-58	-61	-64	-67	-69	-71	-72	-74	-75	-76
-35	-52	-59	-64	-68	-71	-73	-76	-78	-79	-81	-82	-84
-40	-57	-66	-71	-74	-78	-80	-82	-84	-86	-88	-89	-91
-45	-63	-72	-77	-81	-84	-87	-89	-91	-93	-95	-97	-98

Frostbite Times

30 Minutes 10 Minutes 5 Minutes

Table 5. Wind Chill Values Based on Temperature and Wind Speed.

7.13 **<u>Flash Flood (C)</u>.** A rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam-related). Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters. The *Storm Data* preparer must use good, professional judgment in determining when the event is no longer characteristic of a Flash Flood and becomes a Flood. Flash floods do not exist for two or three consecutive days.

River flooding which develops as a result of flash flooding may be included in the narrative. However, such entries should be confined only to the effects of the flooding, such as roads and bridges washed out, homes and businesses damaged, and the dollar estimates of such damage.

7.13.1 <u>General Guidelines for the Determination of a Flash Flood</u>. The guidelines listed below can be used by the Storm Data preparer to aid in the determination as to whether or not a flash flood has occurred. If one or more of the conditions listed below occurs in 6 hours or less, the Storm Data preparer should consider an entry in the Flash Flood section of the StormDat software.

It can be difficult to ascertain whether or not a flash flood has occurred without accurate reports. Questions for observers are provided below that may help with this effort. Basically, if water rose rapidly in places that are normally dry or normally at a much lower level and pose a threat to life or property, the situation may be considered a Flash Flood. For example, water moving over a road causing a car to get swept into a swollen creek (above or within banks) may be considered a Flash Flood. As a guide, a depth of approximately six inches of fast-moving water should be considered as it will knock a person off his/her feet and begin to cause some cars to move out of control. There may also be cases where a lesser amount of swiftly moving water results in impact criteria described below, and could also be considered a Flash Flood.

These Flash Flood guidelines are not meant all-inclusive and may vary locally or regionally. The guidelines are meant to aid the *Storm Data* preparer by giving him/her a starting point.

7.13.2 <u>Suggested Specific Guidelines</u>. A Flash Flood occurs within 6 hours of a causative event such as moderate to heavy rain, dam break, or ice jam release:

- ❑ River or stream flows out of its banks and is a threat to life or property.
- ❑ Person or vehicle is swept away by flowing water from runoff that inundates adjacent grounds.
- ❑ A maintained county or state road is closed by high water.
- ❑ Approximately six inches or more of water flows over a road or bridge. This includes low water crossings in a heavy rain event that is more than localized (i.e., radar and observer reports indicate flooding in nearby locations) and poses a threat to life or property.
- ❑ Dam break or ice jam release causes dangerous out of bank stream flows or inundates normally dry areas, creating a hazard to life or property.
- ❑ Any amount of water in contact, flowing into or causing damage of an above ground residence or public building and is runoff from adjacent grounds.
- ❑ Three feet or more of ponded water that poses a threat to life or property.

- ❑ Mudslide, rock slide or debris flow caused by rainfall (could possibly occur in a burned area with only light to moderate rainfall).

The following can be used as signals to search further for evidence of a Flash Flood, but do not by themselves indicate a Flash Flood has occurred. More supporting information should be gathered - i.e., actual reports of flooding in the area which meet local Flash Flood criteria.

- ❑ Damage to any maintained road.
- ❑ Basement flooding. (This could be due to something other than Flash Flooding.)
- ❑ Mudslide, rock slide or debris flow.

7.13.3 <u>Questions to ask observers, Emergency Managers, etc</u>. Questions should be posed in such a way as to determine whether or not a flooding episode was truly a Flash Flood. Example questions are given below. These could also be used in real time as the heavy rain event becomes a flood.

The following are worded for follow-up verification, but could be re-worded to aid in the determination of a Flash Flood event:

- ❑ Was the river/stream flowing out of banks and a danger to life or property? Was there around 6 inches or more of water flowing over the ground/bridge/road? Do you know about what time this began?
- ❑ Were any roads or bridges closed? Do you know about what time they were first closed?
- ❑ Was water rapidly flowing over the road or land surface (yard, field, etc)?
- ❑ Can you estimate the maximum depth of the moving water? (May ask to compare to car tires. Six inches may verify a warning.)
- ❑ Can you estimate the depth of ponded or standing water? (Three feet of ponded water may verify a warning.)
- ❑ Did water inundate any houses or buildings? If so, was flooding the result of sewer backup or sump pump failure? (If yes to the second question, this does <u>*not*</u> verify a warning.)
- ❑ Were there any evacuations due to flood waters?
- ❑ Can you estimate the beginning and ending time of the flood that created impacts.
- ❑ If you were not present at the time of flooding, can you determine high-water marks on trees, buildings, or other objects?

7.13.4 <u>Low-impact Flooding vs. Threat to Life or Property</u>. In an effort to maintain the most reliable data set it is important to separate low-impact flooding from Flash Flooding. Low-impact flooding should not be considered a Flash Flood. Low-impact flooding does not pose a significant threat to life or property:

- ❑ Minor flooding in urban areas and bottom lands of small streams/creeks (conditions that do not pose a threat to life or property).
- ❑ Minor ponding of water during or after a heavy rain event or flood. (Deep ponding may pose a threat to life and property. A 1988 United States Bureau of Reclamation (USBR) study indicates 3 feet or more as a danger to people and vehicles.)
- ❑ High stream levels due to steady or slowly rising/receding creeks/streams that do not pose a threat to life or property.

There may be times when fatalities or damage occur due to a heavy rain event that does not meet the Flash Flood criteria above, or the event may be so isolated that it was determined not to be a danger to life or property. These are entered in *Storm Data* in the Heavy Rain event (or another suitable event that took place at the same time). A few examples would be the weight of heavy rain collapsing a roof on a single building, and a fatality in a storm drain due to minor urban flooding.

Additionally, there may be times when fatalities occur well after the flood is over. An example would be someone who drives into a receding stream at high levels but within banks, or drives into a flooded underpass that has been barricaded and high for an extended period of time after the flood. These would be recorded as indirect Flood or Flash Flood fatalities.

Note: Direct fatalities which are vehicle-related will be coded as VE. In addition, if a person drives into a flooded area, exits his/her vehicle and drowns, the fatality will be coded as VE (vehicle and/or Towed Trailer), not IW (in water).

Beginning Time - When flood waters began to threaten life or property. In some cases, a flash flood may begin when water left the banks of a river; in others it may be when the water level was 2 to 3 feet above bank-full. It may also be when raging currents of water only 1-foot deep on urban streets swept people off their feet, resulting in a fatality/injury. An important distinction between Flash Flood and Flood events is that a Flash Flood exhibits a rapid rise in water levels, in 6 hours or less, and is usually characterized by rapidly flowing water.

It is possible for a flash flood event to occur during a flood event due to intense rainfall in a short period of time. The beginning time of the flash flood event should correspond to the rapid rise in water levels following the causative event (6 hours or less).

- ❏ A maintained county or state road is first closed by high water.
- ❏ Approximate time when six inches or more of flowing water is observed over a road or bridge.
- ❏ The point at which any amount of water comes in contact, flowing into, or causes damage to an above ground residence or public building and is the runoff from adjacent grounds.
- ❏ The time when three feet or more of water has ponded and poses a threat to life and property. Professional judgment is needed by the *Storm Data* preparer to assess whether this is a climatologically normal event or if it is unusual. For example, an event would not be considered a Flash Flood if ponding three to four feet deep typically occurs with only minimal rainfall.

Ending Time - When flood waters receded to a point where there was no longer any threat to life or property. Alternatively, the ending time of a Flash Flooding event can be defined as the time water levels began to recede. The event may then be continued as a Flood event. Keep in mind that flash flooding may continue to threaten life or property many hours after the causative event ends.

Direct Fatalities/Injuries

- ❏ A person drowned in a flash flood or was struck by an object in flash flood waters.

- ❑ A motorist drowned in an overturned car after driving down a hill onto a flooded stretch of highway that had flood waters 4 feet deep. (It doesn't matter how irresponsible the driver was.)
- ❑ A group of people having a party in an apartment located in a floodplain drowned when flood waters trapped them.
- ❑ Several campers drowned when a thunderstorm 10 miles away in an adjacent county/parish sent a flash flood wave down an arroyo where they camped.
- ❑ Debris or missiles caught in flood waters struck and injured a person walking along a flooding river.
- ❑ A child playing near a stream or storm sewer was swept away by flood waters and drowned.
- ❑ Drowning due to the collapse of a levee or retaining wall caused by flood waters.

Indirect Fatalities/Indirect Injuries

- ❑ Vehicular accidents and incidents that the flash flood contributed to but did not directly cause.
- ❑ Children playing in debris or workers cleaning up debris left by a flood. Debris shifted and child or worker was struck, pinned, or crushed by debris.
- ❑ A flash flood loosened rocks on a mountainside. After the water receded, a rock climber fell to his death after grabbing onto one of the loosened rocks for a handhold.
- ❑ A remote mountain pass road was undermined in a flash flood by a nearby creek. After the water receded, a vehicle drove into the hole in the road, killing the passenger and injuring the driver.

Examples:

Milwaukee County
Wauwatosa to 06 1000CST 2 0 2.5M Flash Flood
Milwaukee 07 0000CST

Tropical-like thunderstorms dumped rainfall amounts of 8 to 12 inches between 1000 and 1900 CST on July 6 in a 7-mile-wide band from the city of Waukesha (Waukesha Co.) east to downtown Milwaukee (Milwaukee Co.). Flash flooding killed two people who drowned when their car was swept away by flood waters at the intersection of I-94 and I-43. Widespread flood damage occurred to 2000 homes and 500 businesses. The maximum rainfall total in Milwaukee County was 11.25 inches, which was measured at the downtown Public Safety Building. M25VE, F24VE

Waukesha County
Waukesha to 06 1000CST 4 10 2.0M Flash Flood
Elm Grove 07 0000CST

Tropical-like thunderstorms dumped rainfall amounts of 8 to 12 inches between 1000 and 1900 CST on July 6 in a 7-mile-wide band from the city of Waukesha (Waukesha Co.) east to downtown Milwaukee (Milwaukee Co.). Widespread flood damage occurred to 500 homes and 150 businesses from the city of Waukesha east through Brookfield and Elm Grove. Four people in a vehicle drowned when flash flood waters up to 5 feet deep flipped their car over at the intersection of I-94 and Moorland Road. Ten people were injured in the city of Waukesha by floating tree debris in Fox River. A cooperative observer in the southern part of Brookfield (Waukesha Co.) measured 11.98 inches of rain between 1100 and 1900 CST on the 6th. M48VE, F46VE, M14VE, F15VE

Herkimer County

Dolgeville	**28 0930EST**	**0**	**0**	**4K**	**Flash Flood**
	1500EST				

An ice jam developed during the morning of February 28 along East Canada Creek at the State Highway 29 bridge in the village of Dolgeville. The water rapidly backed up, flooding the cellars of nearby buildings. The ice jam broke up in the late afternoon without any further flooding downstream.

Cannon County

Woodbury	**07 0830CST**	**0**	**0**	**100K**	**Flash Flood**
	1300CST				

A dam broke and the resultant flash flood damaged a dozen homes downstream. (This example would apply to levees, retaining walls, and other structures.)

7.13.5 <u>Examples of a Flash Flood that Evolved into a Flood</u>.

Kern County

Frazier Park	**10 1900PST**	**0**	**0**	**1.0M**	**Flash Flood**
	11 0100PST				

A powerful storm dropped 3 to 4 inches of rain over portions of Kern County during the afternoon of the 10th. The heavy rains caused flash flooding on several creeks. Frazier Mountain Road between I-5 and Shallock Road and Highway 66 near Maricopa were all washed out by overflowing creeks.

Kern County

Frazier Park	**11 0100PST**	**0**	**0**		**Flood**
	11 1000PST				

A powerful storm dropped 3 to 4 inches of rain over portions of Kern County during the afternoon of the 10th. The heavy rains caused flash flooding on several creeks. Frazier Mountain Road between I-5 and Shallock Road and Highway 66 near Maricopa were all washed out by overflowing creeks. Additional 1 to 2 inches of rain caused creeks to stay in flood and roads to remain closed through the night. Flood waters subsided by late morning on the 11th.

7.14 **<u>Flood (C)</u>.** Any high flow, overflow, or inundation by water which causes or threatens damage. In general, this would mean the inundation of a normally dry area caused by an increased water level in an established watercourse, or ponding of water, generally occurring more than 6 hours after the causative event, and posing a threat to life or property. Refer to the Flash Flood event (Section 7.13) for guidelines for differentiating between Floods and Flash Floods.

River flooding may be included in the Flood category. However, such entries should be confined only to the effects of the river flooding, such as roads and bridges washed out, homes and businesses damaged, and the dollar estimates of such damage. OCWWS at National Weather Service Headquarters will maintain the official records of river stages, flood stages, and crests. Therefore, river stages need not be included in *Storm Data*.

Note: Direct fatalities which are vehicle-related will be coded as VE. In addition, if a person drives into a flooded area, exits his/her vehicle and drowns, the fatality will be coded as VE (vehicle and/or towed trailer), not IW (in water).

Beginning Time - When flood waters began to threaten life or property. In some cases, a flood may have been when water left the banks of a river, in others it may not have been until the water level was 2 to 3 feet above bank-full. Professional judgment should be used by the *Storm Data* preparer.

Ending Time - When flood waters receded to a point where there was no longer any threat to life or property. Keep in mind that flooding may continue to threaten life or property many days after the rain ends.

Direct Fatalities/Injuries

- ❑ A fatality occurred as a result of the person drowning in a flood or being struck by an object in flood waters.
- ❑ A person walked around a barricade into 3-foot deep flood waters near a river. The current swept him off his feet and he drowned.
- ❑ Two people were rafting down a flooded street hanging onto inner tubes. Water turbulence flipped them over, causing them to hit their heads on a curb, and both drowned.
- ❑ Debris or missiles caught in flood waters struck and injured a person walking along a flooded river.

Indirect Fatalities/Injuries

- ❑ Vehicular accidents the flood contributed to but did not directly cause.
- ❑ A person suffered a heart attack while taking part in sandbagging operations.

Example:

Providence County

Northwest	**17**	**0200EST**	**0**	**2**	**3.5M**	**5.7M**	**Flood**
Portion	**18**	**1500EST**					

Widespread low-land flooding occurred in northwest Providence County, resulting in considerable flood damage to 1500 homes, 400 businesses, and 200 agricultural farms. Two men near South Foster were injured by floating debris in the Ponaganset River when they rescued a dog. The flood was initiated by rainfall amounts of 4 to 5 inches (on top of wet ground) that fell between 1800 EST on the 16th and 1800 EST on the 17th.

7.15 **Freezing Fog (Z).** Fog which freezes on contact with exposed objects and forms a coating of rime and/or glaze, on a widespread or localized basis, resulting in an impact on transportation, commerce, or individuals. Freezing fog can occur with any visibility of 6 miles or less. Even small accumulations of ice can have an impact.

Beginning Time – When freezing fog began.

Ending Time – When freezing fog ended.

Direct Fatalities/Injuries – None.

Indirect Fatalities/Injuries
- ❑ Fatalities and injuries resulting from vehicle accidents caused by freezing fog.

Example:

ARZ044 Pulaski
14 0400CST 0 0 Freezing Fog
1100CST
Freezing fog developed during the pre-dawn hours, especially in areas near the Arkansas River, reducing visibility to below ½ mile. The fog resulted in a number of multiple-vehicle accidents during the morning rush hour. The majority of these accidents occurred on elevated sections of Interstate 440, on the river bridges of Interstates 30 and 430, and on the Levy Bridge on Interstate 40. Altogether, the accidents caused five injuries (indirect injuries). Temperatures rose above freezing by late morning, putting an end to the freezing fog.

7.16 **Frost/Freeze (Z).** A surface air temperature of 32 degrees Fahrenheit (F) or lower, or the formation of ice crystals on the ground or other surfaces, over a widespread or localized area for a climatologically significant period of time during the locally defined growing season, causing human/ economic impact.

Beginning Time - When the temperature first fell below freezing or frost began to form.

Ending Time - When the temperature rose above freezing or frost melted.

Direct Fatalities/Injuries
- ❑ None. This *Storm Data* event type applies to agricultural losses. Any fatality in which the medical examiner determined that the primary cause was hypothermia should be entered under the event type Extreme Cold/Wind Chill, or the Cold/Wind Chill event.

Indirect Fatalities/Injuries
- ❑ Any traffic casualties/injuries due to ice formation on roads or bridges and any pedestrian casualties due to icy walkways.

Examples:

FLZ039-042 Levy - Citrus – Hernando
-048 18 0500EST 0 0 50K Frost/Freeze

18 0800EST
Freezing temperatures between 30 and 32 degrees occurred. The average duration was around 1 hour with up to 3 hours in isolated locations. Some crop damage was noted in Levy County.

GAZ028-029	**Hart – Elbert**				
	06 0500EST	**0**	**0**		**Frost/Freeze**
	06 0800EST				

Near record low temperatures in the lower to middle 30s with clear skies and light winds resulted in widespread frost. No crop damage was reported but frost formation on roads and bridges resulted in several traffic accidents, including one fatality (indirect fatality) on Highway 72 at the Broad River Bridge.

7.17 **Funnel Cloud (C).** A rotating, visible, extension of a cloud pendant from a convective cloud with circulation not reaching the ground. This would include cold-air funnels which typically form in a shallow, cool air mass behind a cold front. The funnel cloud should be large, noteworthy, or create strong public interest to be entered.

Beginning Time - When the funnel cloud was first observed.

Ending Time - When the funnel cloud was no longer visible.

Direct Fatalities/Injuries

- ❏ A fatality or injury directly caused by the circulating winds of a funnel cloud. Note that by definition, a funnel cloud fatality can't occur on the ground, so fatalities or injuries can only be associated with aviation mishaps. (Rare)

Indirect Fatalities/Injuries

- ❏ All fatalities/injuries that resulted from distress brought on by the sight of the funnel cloud or by any telecommunication to those individuals of the possibility of funnel clouds.

Examples:

Tolland County					
Gilead	**10 1800EST**	**0**	**0**		**Funnel Cloud**
	1805EST				

A funnel cloud was observed by local law enforcement officials and Amateur Radio operators. It extended about half way from the cloud base to the ground as it passed over town.

Power County					
13 E American	**30 1300MST**	**0**	**1**	**150K**	**Funnel Cloud**
Falls	**1302MST**				

A small airplane flew into a funnel cloud west of Pocatello; and based on reports from highway motorists, the pilot lost control. The pilot crash-landed at the Pocatello Municipal Airport and was injured. The plane was a total loss based on the insurance claim.

Deuel County

3 S Chappell	**21**	**1612MST 1620MST**	**0**	**0**			**Funnel Cloud**

A cold air funnel was observed 3 miles south of Chappell and persisted for 8 minutes. The funnel was observed by numerous citizens in Chappell and motorists who stopped along Interstate 80.

7.18 **<u>Hail (C)</u>.** Frozen precipitation in the form of balls or irregular lumps of ice. Hail 3/4 inch or larger in diameter will be entered. Hail accumulations of smaller size which cause property and/or crop damage, or casualties, should be entered. Maximum hail size will be encoded for all hail reports entered.

StormDat software permits only one event name for encoding severe and non-severe hail events, and allows the preparer to enter any hail size in hundredths of an inch. Therefore, the preparer is not restricted to only those sizes that appear in Table 4 of Section 7.18.1. If hail diameters are equal to, or greater than, 3/4 inch, a hail event always will be encoded. If hailstones with diameters less than 3/4 inches result in fatalities, injuries, or significant damage, encoding a hail event is recommended. Encoded values of estimated or measured hail diameters below 3/4 inch (non-severe), regardless of extent and/or severity of fatalities, injuries, and damage, will not initiate the verification process.

<u>Beginning Time</u> - When hail first occurred.

<u>Ending Time</u> - When hail ended.

<u>Direct Fatalities/Injuries</u>

- ❏ Baseball-size hail struck a person in the head, causing a fatality/injury.
- ❏ A fatality/injury directly caused by wind driven hail where both the hail size and winds were below severe criteria. This would be an extremely rare event.

<u>Indirect Fatalities/Injuries</u>

- ❏ Hail covered the road. A vehicle lost control on the slippery road and crashed into a tree, killing or injuring the driver.
- ❏ Hail falls with sufficient intensity to restrict visibility causing a driver to lose control of a vehicle. The vehicle rolls over or hits an object, resulting in a fatality/injury.

<u>Examples</u>:

Medina County

Brunswick	**20**	**1730EST 1735EST**	**1**	**3**	**1.3M**	**50K**	**Hail (4.00)**

A prolific hailstorm sat over Brunswick, Ohio, for 5 minutes, resulting in a fatality, injuries, and considerable property damage. A 10-year old boy died on a ball field due to head injuries sustained in a barrage of 4-inch diameter hail.

Three other boys suffered head injuries. The large hail damaged at least 500 vehicles, and 700 homes reported broken windows or awnings. The ground was covered white, and the hail didn't melt until the following afternoon. M10BF

King County

Guthrie	**02**	**2240CST** **2245CST**	**0**	**0**		**500K**	**Hail (0.50)**

Hail up to ½ inch in diameter accumulated to several inches. The hail completely flattened and shredded young corn crops at several farms near Guthrie. Insurance company officials declared the corn crop a total loss.

7.18.1 Hail Conversion Table. To assist in the task of converting spotter hail reports to actual hail diameter, a recommended guideline follows in Table 6. The comparisons may not be accurate, but may used for estimates. Care must be exercised since apples, softballs, and grapefruit come in different sizes. For example, softballs range in size from 3.50 inches to 5.09 inches. Additionally, dime-size hail was the coin type associated with 0.75-inch diameter hailstones for many years. However, the diameter of a dime is 11/16 inch, slightly smaller than a penny, which is 12/16 inch (0.75 inch). Also, for many years, marble-size hail was associated with hailstones ½ inch in diameter. However, marbles come in different sizes. Therefore, use of the term "marble-size" or "dime-size" hail is not recommended.

Pea	0.25 - .375 inch	Lime	2.00 inches
-	0.50 inch	Tennis Ball	2.50 inches
Penny	0.75 inch	Baseball	2.75 inches
Nickel	0.88 inch	Large Apple	3.00 inches
Quarter	1.00 inch (15/16")	Softball	3.50 inches
Half dollar	1.25 inch	Grapefruit/Softball	4.00 inches
Walnut/Ping Pong	1.50 inch	Computer CD	5.00 inches
Golf ball	1.75 inch		

Table 6. Hail Conversion Table.

7.19 **Heat (Z).** A period of heat resulting from the combination of high temperatures (above normal) and relative humidity. A heat event occurs and is reported in *Storm Data* whenever heat index values meet or exceed locally/regionally established advisory thresholds. Fatalities or major impacts on human health occurring when ambient weather conditions meet heat advisory criteria are reported using the heat category. If the ambient weather conditions are below heat advisory criteria, a heat event entry is not made.

Depending on the part of the country experiencing high temperatures, the heat effects are modulated by relative humidity, cloud cover, wind speeds, the duration of a hot spell, the time of the year, and other factors, including mortality rates and types of housing.

In some heat waves, fatalities occur in the few days following the meteorological end of the event. The preparer should include these fatalities in the Heat event, but encode the actual date of the directly related fatalities in the fatality entry table.

Beginning Time - When local thresholds for heat were first met or when unseasonably or abnormally hot conditions began.

Ending Time - When local thresholds for heat were no longer met or unseasonably or abnormally hot conditions ended.

Direct Fatalities/Injuries

- ❏ Fatality where heat-related illness or heat stress was the primary or major contributing factor as determined by a medical examiner or coroner.
- ❏ An elderly person suffered heat stroke and died inside a stuffy apartment during a heat wave.
- ❏ Cases in which people receive medical treatment for heat-hyperthermia (severe dehydration, sunstroke, heatstroke, etc.) can be considered an injury.

Indirect Fatalities/Injuries

- ❏ Fatality where heat stress was the secondary, or contributing factor, but the heat was man-made and ambient conditions are not abnormally hot or extreme. The heat fatality was not weather-related.
- ❏ A toddler was left inside a car while a parent went inside a grocery store on a sunny day where ambient conditions did not meet the local criteria for a heat advisory (heat index only in the 80s.) The windows were left rolled up, and the toddler died. In this case the toddler clearly would have survived in the ambient conditions if the windows were down.
- ❏ A medical examiner reported a man working at a steel mill died primarily of heat stress. The outside temperature was only 72 degrees on May 1st in Chicago (weather conditions didn't meet ambient heat advisory criteria).

Example:

MOZ064	**St. Louis**			
	02 1300CST	**1**	**0**	**Heat**
	05 2000CST			

Unseasonably hot and humid weather settled over Missouri during the first five days of March. On March 4th, record-setting maximum air temperatures of 90 degrees combined with dew points of 70-75 resulted in heat index values of 95 to 100. As a result, 1 person in St. Louis died from the effects of this heat. F90PH.

7.20 **Heavy Rain (C).** Unusually large amount of rain which does not cause a flash flood or flood, but causes damage, e.g., roof collapse or other human/economic impact. Heavy rain situations resulting in urban and/or small stream flooding should be classified as a Heavy Rain event, or another suitable event that occurred at the same time.

Beginning Time - When heavy rain that led to damage began.

Ending Time - When heavy rain diminished to the degree that it no longer posed a threat to life or property.

Direct Fatalities/Injuries

- ❑ A fatality or injury caused by debris from a structural collapse resulting from water loading.

Indirect Fatalities/Injuries

- ❑ All fatalities/injuries that resulted from vehicle accidents due to hydroplaning, or from sliding on slippery road surfaces, or from poor visibility.

Example:

Minnehaha County

Sioux Falls	**03**	**1100CST** **1200CST**	**2**	**7**	**300K**	**Heavy Rain**

A short-lived but intense thunderstorm dumped 2 inches of rain between 1100 and 1130 CST, resulting in the collapse of a roof of an old school building at noon. Two students were crushed by roof debris, and 7 others were injured. Apparently, the rain came down so hard that water loading on the roof led to the roof collapse. Minor street flooding occurred elsewhere in Sioux Falls, but in general the city's drainage system was up to the task. M8SC, M9SC

7.21 **Heavy Snow (Z).** Snow accumulation meeting or exceeding locally defined 12 and/or 24 hour warning criteria, on a widespread or localized basis. This could mean such values as 4, 6, or 8 inches or more in 12 hours or less; or 6, or 8, or 10 inches in 24 hours or less. In some heavy snow events, structural damage, due to the excessive weight of snow accumulations, may occur in the few days following the meteorological end of the event. The preparer should include this damage as part of the original event and give details in the narrative.

The *Storm Data* preparer should include in the narrative the time the snow began to accumulate

Beginning Time - When regionally/locally established heavy snow values were first reached. The beginning time of the accumulating snow should be included in the narrative.

Ending Time - When snow accumulation ended.

Direct Fatalities/Injuries

- ❑ A fatality/injury from a mass of snow sliding off a roof or falling through a structure.
- ❑ A tree toppled from heavy snow and landed on someone, killing him.
- ❑ A person walking through deep snow, fell down, and died of exposure.

Indirect Fatalities/Injuries

- ❏ Any fatality from a vehicle accident related to deep snow on the roads or slippery roads.
- ❏ Any vehicle accident involved with a snow plow.
- ❏ Any fatality related to shoveling or moving snow.

Examples:

IAZ013-014 Fayette - Clayton
25 1400CST 0 0 Heavy Snow
25 1800CST
Snow began at 1000 CST and reached 6 inches at 1400 CST and tapered off to flurries by 1800 CST. A total of 6 to 8 inches of snow fell from Oelwein to Strawberry Point.

VTZ013-014 Bennington - Windham
11 2200EST 1 0 Heavy Snow
12 1800EST
Record-breaking heavy snow pounded the southern part of Vermont. Accumulations of 30 to 40 inches paralyzed the region. Travel and commerce came to halt, and there were numerous reports of downed power lines and structural damage due to the weight of snow on roofs. Some roofs of businesses collapsed during the 2 days following the end of the heavy snow since clean-up crews were unable to reach those buildings. One person died from exposure after he left his snow-covered vehicle and attempted to walk to a nearby residence during the height of the storm. Accumulating snow and lower visibilities began at 1500 EST on the 11th, and reached 6 inches at 2200 EST. Thereafter, accumulation rates increased to 2 to 3 inches per hour through the overnight and morning hours. M70OU

7.22 **High Surf (Z)**. Large waves breaking on or near shore, resulting from swell spawned by a distant storm or from strong onshore winds, causing a fatality, injury or damage. In addition, if accompanied by anomalous astronomical high tides, high surf may produce beach erosion and possible damage to beachfront structures. High surf conditions are usually accompanied by rip currents and near-shore breaks.

Beginning Time - When near-shore wave heights met locally developed criteria (usually 7 to 10 feet).

Ending Time - When near-shore waves subsided below locally developed criteria.

Direct Fatalities/Injuries

- ❏ A surfer ventured out into severe wave conditions and was injured or drowned.
- ❏ A man fishing off a pier was swept into the sea.
- ❏ A boat traversing an ocean inlet foundered on the rocks and the boaters drowned.

Indirect Fatalities/Injuries

- ❏ A swimmer, struggling to get out of the high surf, suffered a heart attack.

Examples:

CAZ042-043 Orange County Coast - San Diego County Coast
09 2000PST 0 2 2M High Surf
10 0600PST
A powerful Pacific storm generated towering surf and swells that battered beachfront buildings. Waves which occasionally reached 15 to 20 feet damaged 32 homes in San Clemente. A Solana Beach lifeguard was injured while rescuing a drowning teen who also suffered minor injuries.

VAZ098>100 Virginia Beach - Northampton - Accomack
15 1500EST 0 0 10M High Surf
16 1200EST
A strong nor'easter caused significant beach and property damage along the Atlantic coast from Virginia Beach, VA, to Ocean City, MD. At least 100 vacation homes reported damage.

7.23 **High Wind (Z).** Sustained non-convective winds of 35 knots (40 mph) or greater lasting for 1 hour or longer or winds (sustained or gusts) of 50 knots (58 mph) for any duration (or otherwise locally defined), on a widespread or localized basis. In some mountainous areas, the above numerical values are 43 knots (50 mph) and 65 knots (75 mph), respectively.

The High Wind event name will be used for wind damage reports from inland counties/parishes that experienced the effects of hurricanes and tropical storms. Refer to Sections 7.24 and 7.42 for additional details. Otherwise, the High Wind event name will not be used for severe local storms, tropical cyclones, or winter storm events.

When high wind conditions are satisfied, a *Storm Data* event entry is required, and the preparer will indicate in the entry table whether the wind value represents a maximum sustained wind, or maximum wind gust. Depending on the choice, the software will place an S or G in front of the wind value that appears in the *Storm Data* publication. Additionally, the StormDat software program requires the preparer to indicate whether the wind gust value, or sustained wind value, is measured or estimated. Refer to Table 9 in Section 7.39.4 for wind speed and damage factors.

Events with winds less than the threshold numbers, resulting in fatalities, injuries, or significant property damage, will be encoded as a "strong wind" event. Similar to the high wind event, the preparer will indicate whether the strong wind event is based on a maximum wind gust or maximum sustained wind value.

Events over large inland lakes (with no specific, assigned Marine Forecast Zone number) that meet High Wind criteria will be entered as a High Wind event, rather than a Marine High Wind event.

Beginning Time - When sustained winds or wind gusts first equaled or exceeded regionally established criteria for high wind. Wind speed values can be inferred from damage reports.

Ending Time - When sustained wind or wind gusts dropped below high wind criteria.

Direct Fatalities/Injuries

- ❏ Fatalities or injuries caused by being struck by falling debris associated with structural failure (including falling trees, utility poles, and power lines).
- ❏ Fatalities or injuries associated with vehicles that were blown over, or vehicles that were blown into a structure or other vehicle.
- ❏ Fatalities or injuries caused by people or vehicles that were struck by airborne objects.
- ❏ Drowning due to boat capsized by wind.

Indirect Fatalities/Injuries

- ❏ Fatalities or injuries when vehicles collided with stationary obstructions/debris placed in roadways by high wind.
- ❏ Any fatalities or injuries incurred during the clean-up process.
- ❏ Fatalities or injuries associated with contact with power lines after they fell.
- ❏ Any fatalities or injuries that loss of electrical power contributed to, including lack of heat, cooling, or light, or failure of medical equipment.

Examples:

MNZ088-095 Fillmore - Winona
30 0100CST 0 0 2.5K High Wind (G56)
0900CST
Winds gusting to an estimated 56 knots (65 mph) for about 8 hours blew down numerous trees and toppled dozens of signs in Spring Valley and Lewiston. A young girl in Spring Valley was killed when she touched a downed power line (indirect fatality). The high winds were generated by a deep low pressure moving northeast through the Minnesota Arrowhead region.

SDZ001-002- Butte - Harding - Meade - Perkins
012-013 06 0900MST 0 0 High Wind (S39)[M]
1300MST
Sustained west winds reached 39 knots (40 to 45 mph) for several hours across northwest South Dakota behind a fast-moving cold front. Uncharacteristically, there were no gusts of 50 knots (58 mph) or higher.

7.24 **Hurricane/Typhoon (Z).** A tropical cyclone in which the maximum 1-minute sustained surface wind is 64 knots (74 mph) or greater. In the Atlantic Ocean or the North Pacific Ocean east of the International Date Line this event would be labeled a Hurricane, and in the North Pacific Ocean west of the International Dateline this event would be classified as a Typhoon. Hurricane/Typhoon entries in *Storm Data* are based upon the wind speed observed in the CWFA.

The hurricane/typhoon will usually include many individual hazards, such as storm tide, freshwater flooding, tornadoes, rip currents, etc. The only fatalities, injuries, and damage amounts reported in the Hurricane/Typhoon data header strip will be those associated with wind damage (the other hazards will already be reported in their respective *Storm Data* entries).

Include the other hazard information in the Hurricane/Typhoon narrative to ensure a complete synopsis for the event.

Note: Tropical cyclone entries in *Storm Data* are based upon the wind speeds observed in the WFO's coastal and marine zones. If a hurricane produces only tropical storm force winds in a particular CWFA, the entry should be made under Tropical Storm. However, such entries must include a reference the hurricane in the narrative section, e.g., "Hurricane Dennis produced tropical storm force winds in ...."

7.24.1 Separating the Various Hurricane/Typhoon Hazards. After a tropical cyclone event, offices will: (a) have an entry for the tropical cyclone, summarizing the total impact, and (b) separately list the impacts attributed to individual hazards events (storm tide, freshwater flooding, tornadoes, mudslides, inland high winds, rip currents, etc.). These separate event entries (i.e., their associated fatalities, injuries, and damage amounts) are not included/encoded as part of the header strip of the tropical cyclone event. Terrain (elevation) features, in addition to the storm tide/run-up height, will determine how far inland the coastal flooding extends. The name of the tropical cyclone will be included in the narrative of all associated individual hazards/events.

The only individual hazard that will be encoded with one of the three tropical cyclone event names is wind damage in coastal counties/parishes. This restriction prevents a "double-count" from occurring in the national report entitled "*A Summary of Natural Hazard Fatalities for [Year] in the United States*," which is based upon the header strips of *Storm Data* events. In other words, the fatalities, injuries, and damage amounts appearing in the header strip of a tropical cyclone are attributed only to wind damage experienced in the coastal counties/parishes listed in the header strip. The effects from the other individual hazards associated with a tropical cyclone can be found in other cyclone-related events.

In order to provide complete documentation of the tropical cyclone effects, the *Storm Data* preparer will do two additional things:

a. Insert into the tropical cyclone narrative the total fatalities, injuries, and damage amounts attributed to *all* tropical cyclone hazards, for affected coastal and inland counties/parishes within a CWFA (e.g., "The collective effects of Hurricane Alpha during the period of August 1-3, resulted in 10 fatalities, 50 injuries, $800M in property damage, and $200M in crop damage in the counties of S, T, U, V, W, X, Y, and Z"). This will ensure that all tropical cyclone effects are summarized in one phrase; and

b. Provide in the tropical cyclone narrative, a general breakdown of fatalities, injuries, and damage amounts attributed to individual hazards/events, for both coastal and inland counties/parishes (e.g., "During the passage of Hurricane Alpha in the counties of S, T, U, V, W, X, Y, and Z, five tornadoes killed 3 people and resulted in $1.0M in property damage, flash floods injured 20 people and resulted in $175M in crop damage, rip currents resulted in 5 fatalities," etc.).

In addition, the following information will be included in the narrative for tropical cyclones at coastal locations:

- Tropical cyclone name;
- The point of landfall;
- Storm tide;
- Minimum surface pressure; and
- Saffir-Simpson Hurricane Scale or Saffir-Simpson Tropical Cyclone Scale, upon landfall, as appropriate.

The following information will be included for both coastal and inland locations:

- Maximum sustained wind speed/peak gusts;
- Rainfall totals; and
- Record-breaking data.

Effects that occur well outside the circulation of the tropical cyclone, such as swells that may occur hundreds of miles away, will be listed under another specific event, such as Rip Current or High Surf, with its narrative mentioning the tropical cyclone as a secondary effect.

In some situations, there may be tropical cyclone-related hazards, as mentioned above, occurring prior to or after the beginning/ending time of the tropical cyclone event. Professional judgment must be exercised in determining if these related hazards are part of the cyclone. Refer to Sections 2.6.3 and 2.7.4 for the decision process.

Damage listed in the header strip of the individual hazards, or the tropical cyclone, should not include such things as business losses from reduced tourism, etc.

Tables 7 and 8 in Section 7.24.2 depict the Saffir-Simpson Hurricane Scale and Saffir-Simpson Tropical Cyclone Scale.

<u>Beginning Time</u> - When the direct effects of the hurricane/typhoon were first experienced.

<u>Ending Time</u> - When the direct effects of the hurricane/typhoon were no longer experienced.

<u>Direct Fatalities/Injuries</u>

❏ Casualties caused by storm tide, rough surf, freshwater flooding, mudslides, or wind-driven debris or structural collapse.
❏ The wind caused a house to collapse or blew a tree onto someone.
❏ A person drowned while surfing in rough waters.
❏ The storm tide drowned people in a beach house.
❏ Someone drowned when flood-waters swept a vehicle into a river.

<u>Indirect Fatalities/Injuries</u>

❏ Someone suffered a heart attack while removing debris.
❏ Someone was electrocuted by touching downed power lines.
❏ Someone drowned when a vehicle was driven into a canal.

❑ Someone was killed in a vehicle accident caused by a hurricane-related missing traffic signal.

Examples:

FLZ018-021 Broward - Collier - Dade - Monroe
>023 24 0325EST 4 50 13B 750M Hurricane/Typhoon
0900EST

The eye of Hurricane Andrew moved ashore in south Dade County near Homestead with a minimum central pressure of 922 mb and maximum storm surge of 16.9 feet. Maximum sustained winds were estimated at 145 knots (165 mph) with gusts to at least 152 knots (175 mph). Andrew was a Category 5 storm on landfall and was the third strongest in U.S. history. In southeast Florida, the maximum rainfall was 7.79 inches in Broward County. The height of the storm tide (the sum of the storm surge and astronomical tide, referenced to mean sea level) ranged from 4 to 6 ft in northern Biscayne Bay increasing to a maximum value of 16.9 ft at the Burger King International Headquarters, located on the western shoreline in the center of the bay, and decreasing to 4 to 5 ft in southern Biscayne Bay. The observed storm tide values on the Florida southwest coast ranged from 4 to 5 ft near Flamingo to 6 to 7 ft near Goodland. In Broward, Collier, Dade, and Monroe Counties, the winds killed 4 people (trees falling on moving vehicles). All of the associated effects of Andrew in southeast Florida resulted in 15 fatalities, 250 injuries, $25.0B in property damage, and around $1.0B in crop damage. Specifically in southeast Florida, Andrew's inland flood waters resulted in 5 fatalities, 100 injuries, $5B in property damage, and $250M in crop damage. The eight associated tornadoes resulted in 2 fatalities, 25 injuries, and $1B in property damage. The powerful winds resulted in 4 fatalities, 50 injuries, $13B in property damage, and $750M in crop damage. The storm tide along the coast resulted in 4 fatalities, 75 injuries, $6M in property damage. Besides the 15 direct fatalities, at least 26 indirect fatalities occurred, during clean-up activities. M67VE, F12VE, M45VE, F46VE

GUZ001 Guam
15 1700ChST 0 1 254M Hurricane/Typhoon
16 1200ChST

Typhoon Paka formed in the central North Pacific southwest of the Hawaiian Islands on November 28 and tracked westward crossing the International Dateline around 1200 SST December 7. Paka entered the Marshall Islands as a tropical storm on December 10 became a typhoon on December 11 and crossed through the Marshall Islands until December 14, damaging structures and crops. Paka became a super typhoon on December 15 and passed 5 miles north of Guam. The lowest pressure observed on Guam was 948 mb and the highest sustained wind was measured at 100 knots (115 mph) with a gust to 152 knots (175 mph). On the Saffir-Simpson Tropical Cyclone Scale, this corresponds to a Category 3 typhoon based on the sustained-wind value but more accurately to a Category 4 typhoon based on the gust value. Maximum storm tide on Guam was about 30 feet (run-up/debris line) at Arunao Beach on the northwest coast, 16 feet (run-up/debris line) at the Commercial Port, 13 feet (run-up/debris line) on the north side of Tumon Bay (standing water measurement), and 8 feet (run-up/debris line) on Agana Bay. Maximum rainfall at WFO Guam was 20.75 inches from 16 December at 1600 ChST to 17 December at 1600 ChST. While Paka was on Guam, the typhoon winds resulted in 1 injury (debris hit a person on the head), and damaged numerous businesses and homes. Collectively, all of the effects of Typhoon Paka resulted in no fatalities, 2 people injured, and over $504M in property damage. Specifically, Paka's flood waters resulted in 1 injury, and $200M in property damage; associated winds resulted in 1 injury and over $254M in property damage. The storm tide resulted in $50M in property damage.

7.24.2 Tables for Determining Saffir-Simpson Hurricane Scale and Saffir-Simpson Tropical Cyclone Scale**.**

CATEGORY (SCALE NUMBER)	**WIND SPEED**	**STORM TIDE (FT)**	**DAMAGE**
1	64-82 kts (74-95 mph)	4-5	Minor
2	83-95 kts (96-110 mph)	6-8	Moderate
3	96-113 kts (111-130 mph)	9-12	Major
4	114-135 kts (131-155 mph)	13-18	Severe
5	Greater than 135 kts (Greater than 155 mph)	Greater than 18	Catastrophic

Table 7. Saffir-Simpson Hurricane Scale.

Note: A scale ranging from 1 to 5 based on a hurricane's intensity. This can be used to give an estimate of the potential property damage and flooding expected. In practice, wind speed is the parameter that determines the category since storm tide is highly dependent on the slope of the continental shelf. Storm tide (run-up/debris line) equals sum of storm surge and astronomical tide.

Tropical Storm Categories	Sustained Winds	Wind Gusts	Tide WR	Tide NR	Damage Level	Description of Damages and Storm Tide/Inundation
A Weak	26-43 kts (30-49 mph)	33-56 kts (40-64 mph)	<1 ft	1 ft	Tiny	Damage only to the flimsiest lean-to type structures and tents. Minor damage to huts made of thatch or loosely attached corrugated sheet metal or plywood. Salt spray causes majority of damage to vegetation. Rough surf at reef front with moderately strong rip currents inside reef.
B Severe	44-63 kts (50-73 mph)	57-81 kts (65-94 mph)	<1 ft	1-2 ft	Small	Major damage to huts made of thatch or loosely attached corrugated sheet metal or plywood; sheet metal and plywood may become airborne. Minor damage to buildings of light materials. Moderate damage to banana and papaya trees, and most fleshy crops. Very rough surf at reef front with strong rip currents inside reefs.
Typhoon Categories	**Sustained Winds**	**Wind Gusts**	**Surge WR**	**Surge NR**	**Damage Level**	**Description of Damages and Storm Tide/Inundation**
1 Minimal	64-82 kts (74-95 mph)	82-105 kts (95-120 mph)	1-2 ft	2-4 ft	Minimal	Corrugated sheet metal and plywood stripped from poorly constructed or termite-infested structures and may become airborne. A few wooden, non-reinforced power poles tilted and some rotten power poles broken. Some secondary power lines downed. Major damage to exposed banana and papaya trees, and fleshy crops. Some palm fronds crimped and bent back through the crown of coconut palms. Less than 10% defoliation of trees and shrubs. Minor pier damage. Some small boats in exposed anchorages break moorings.

Typhoon Categories	Sustained Winds	Wind Gusts	Surge WR	Surge NR	Damage Level	Description of Damages and Storm Tide/Inundation
2 Moderate	83-95 kts (96-110 mph)	106-121 kts (121-139 mph)	2-4 ft	4-6 ft	Moderate	Damage to wooden and tin roofs and door and windows of termite-infested or rotted structures, but no major damage to well-constructed wooden, sheet metal, or concrete structures. Considerable damage to structures made of light materials. Several rotten power poles snapped and many non-reinforced poles tilted. Many secondary power lines down. Exposed banana and papaya trees totally destroyed; 10-20% defoliation of trees and shrubs. Some erosion of beaches, some moderate pier damage and some exposed large boats torn from moorings.
3 Strong	96-113 kts (111-130 mph)	121-144 kts (140-165 mph)	5-8 ft	6-10 ft	Extensive	Some roof, window and door damage to well-built wooden and metal residences and industrial buildings. Extensive damage to structures weakened by termites, wood rot and corroded roof/hurricane straps. Non-reinforced cinderblock walls blown down. Many mobile homes and buildings of light materials destroyed. Some glass failure due to flying debris but minimal glass failure due to pressure forces associated with extreme gusts. A few non-reinforced hollow-spun concrete power poles broken or tilted and many non-reinforced wooden poles broken or blown down. Chain-link fences begin to blow down. Some light and high-paneled vehicles overturned. Some unsecured construction cranes blown down. Air is full of light projectiles and debris. Coconut palms begin to lose crowns. Considerable beach erosion. Many large boats and some large ships torn from moorings.

Typhoon Categories	Sustained Winds	Wind Gusts	Surge WR	Surge NR	Damage Level	Description of Damages and Storm Tide/Inundation
4 Very Strong	114-135 kts (131-155 mph)	145-171 kts (166-197 mph)	8-12 ft	10-15 ft	Extreme	Complete failure of many non-concrete roof structures and unprotected window frames and doors; many well-built wood and sheet metal structures severely damaged or destroyed. Considerable glass failure due to flying debris and explosive pressure forces from extreme wind gusts. Weakly reinforced cinderblock walls blown down. Some reinforced hollow-spun concrete power poles and numerous reinforced wooden power poles blown down; numerous secondary and a few primary power lines downed. Support poles of chain-link fences bent 90 degrees. Some secured construction cranes blown down. Some fuel storage tanks damaged. Considerable damage to airport jet-ways. Air is full of large projectiles and debris. Shrubs and trees 50-90% defoliated. Severe beach erosion. Severe damage to port facilities including some loading derricks and gantry cranes. Most ships torn from moorings.
5 Devastating	136-170 kts (156-194 mph)	171-216 kts (198-246 mph)	12-20 ft	15-28+ ft	Catastro-phic	Total failure of non-concrete reinforced roofs; extensive damage to total destruction of non-concrete residences and industrial buildings. Some structural damage to concrete structures from large debris such as cars and large appliances. Extensive glass failure due to impact of flying debris and explosive pressure forces during extreme wind gusts; many well-constructed typhoon shutters ripped from structures. Some fuel storage tanks ruptured. Most cranes blown down. Air is full of very large and heavy projectiles and debris. Shrubs and trees up to 100% defoliated. Numerous crowns and virtually all green coconuts blown from palm trees. Most bark stripped from trees and wood is severely sandblasted. Most standing trees are devoid of all but largest branches, which are stubby in appearance. Numerous very large boulders carried inland with waves. Extensive to complete beach erosion. Extensive damage to total destruction of port facilities including derricks and cranes. Virtually all ships, regardless of size, torn from moorings.

Table 8. Saffir-Simpson Tropical Cyclone Scale Table (Guard and Lander 1999) for the Pacific Ocean. Sustained winds and wind gusts are in miles per hour (mph). “Tide” refers to the vertical height of run-up (storm tide) or inundation. Storm tide (run-up/debris line) equals sum

of storm surge and astronomical tide. Tide heights are in feet. "WR" refers to "wide" coral reefs with the reef front greater than 250 feet from shore; "NR" refers to "narrow" reefs with the reef front less than or equal to 250 feet from shore. "TS" refers to tropical storm.

7.25 **Ice Storm (Z).** Ice accumulation meeting or exceeding locally defined warning criteria (typical value is 1/4 or 1/2 inch or more), on a widespread or localized basis. The *Storm Data* preparer should include in the narrative the time that ice began to accumulate.

Beginning Time - When ice accumulations exceeded locally established values or as inferred by damage reports.

Ending Time - When ice accumulation stopped.

Direct Fatalities/Injuries

- A large chunk of ice falls off a structure and strikes and kills someone.
- Large tree or other structure falls or collapses (due to ice load) and kills someone.

Indirect Fatalities/Injuries

- All vehicle-related fatalities due to ice covered roads and hazardous driving conditions.
- Someone suffers a heart attack or dies while removing or cleaning up downed trees or other structural debris.
- Any fatality/injury suffered by workers involved in post-storm recovery.
- Power is lost and people die from extreme cold.
- A man dies from hypothermia after falling down a flight of stairs in his dark, unheated home. This fatality does not fall under the Extreme Cold/Wind Chill category because it occurred indoors.

Example:

MEZ007>009-012 Northern Oxford - Northern Franklin - Central Somerset - Southern Oxford

06 0300EST	**1**	**0**	**304M**	**Ice Storm**
08 1100EST				

A severe ice storm hit sections of central and southern Maine where 1 to 3 inches of ice accumulated on trees, power lines, and other exposed surfaces. Nearly everyone in the region experienced power loss. Due to the added weight of ice, an ice-covered tree limb broke and fell on a man who was walking underneath a tree. The man died from head injuries. M36OU

7.26 **Lakeshore Flood (Z).** Flooding of lakeshore areas due to the vertical rise of water above normal level caused by strong, persistent onshore wind and/or low atmospheric pressure, resulting in damage, erosion, flooding, fatalities, or injuries. Lakeshore areas are defined as those portions of land zones (coastal county/parish) adjacent to the waters of the Great Lakes, Lake Okeechobee, and Lake Pontchartrain. Further inland, the *Storm Data* preparer must determine when and where to encode a flood event as Flash Flood or Flood. Terrain (elevation) features will determine how far inland the lakeshore flooding extends.

For Storm Data, coastal flood events that are associated with a storm of tropical origin (e.g., hurricane, typhoon, or tropical storm) should be reported under the Storm Surge/Tide event category; all other lakeshore flooding events should be reported here.

Beginning Time - When the water level began to cause damage or flooding.

Ending Time - When the water level dropped to a point where damage or flooding ended.

Direct Fatalities/Injuries

- ❑ A lakeshore dwelling was washed away injuring/killing the occupants.
- ❑ A person drowned when a vehicle was swept away by the storm surge.

Indirect Fatalities/Injuries

- ❑ A person suffered a heart attack while evacuating from a storm surge.
- ❑ A person died in a vehicle accident caused by the storm surge washing away a traffic signal.
- ❑ A person died in a vehicle accident after losing control in standing water on a road.

Example:

ILZ014	**Cook**				
	27 0600CST 1200CST	**0**	**0**	**25K**	**Lakeshore Flood**

Strong low pressure produced northeast winds of 26 to 39 knots (30 to 45 mph) down Lake Michigan. The Department of Transportation estimated a storm tide of 2 feet and 10- to 15-foot waves along the Chicago lakefront. Lake Shore Drive was closed due to water and sand on the pavement. Damage occurred to a marina's pier.

7.27 **Lake-Effect Snow (Z).** Localized, convective snow bands that occur in the lee of large bodies of water, e.g. the Great Lakes or the Great Salt Lake, when relatively cold air flows over warm water. In extreme cases, snowfall rates of several inches per hour and thunder and lightning may occur. Lake-effect snow accumulations must meet or exceed locally defined 12 and/or 24 hour warning criteria (typical values of 6 to 8 inches within 12 hours or 8 to 10 inches within 24 hours). In some lake-effect snow events, structural damage, due to the excessive weight of snow accumulations, may occur in the few days following the meteorological end of the event. The preparer should include this damage as part of the original event and give details in the narrative.

The *Storm Data* preparer should include in the narrative the time the snow began to accumulate.

Beginning Time - When regionally established lake-effect snow values were first reached. The beginning time of the snow storm should be included in the narrative.

Ending Time - When snow accumulation ended.

Direct Fatalities/Injuries

- ❑ A fatality/injury from a mass of snow sliding off a roof or falling through a structure.
- ❑ A tree toppled from heavy snow and landed on someone, killing him.
- ❑ A person walking through deep snow, fell down, and died of exposure.

Indirect Fatalities/Injuries

- ❑ Any fatality from a vehicle accident related to deep snow on the roads or slippery roads.
- ❑ Any vehicle accident involved with a snow plow.
- ❑ Any fatality related to shoveling or moving snow.

Examples:

OHZ003-013>014 **Cuyahoga – Geauga - Ashtabula**
16 0800EST **0** **0** **Lake-Effect Snow**
17 1500EST

An area of low pressure moved northeast across the Ohio Valley. Cold west to northwest winds behind the low caused lake-effect snow showers to develop in northeast Ohio. This activity began during the predawn hours of the 16th and continued through midday on the 17th. The heaviest snow fell during the late afternoon and evening hours of the 16th when visibilities at times were near zero. Accumulations ranged from 6 to 8 inches in Geauga, southern Ashtabula and eastern Cuyahoga Counties. Dozens of accidents were reported.

PAZ002-003 **Southern Erie - Crawford**
19 0600EST **0** **0** **Lake-Effect Snow**
20 2000EST

Cold northwest winds blowing across Lake Erie caused lake-effect snow showers to develop early on the 19th. This activity persisted into the evening hours and then dissipated. Accumulations on the 19th ranged from 6 to 10 inches. Just after midnight on the 20th, an intense band of snow redeveloped over southern Erie and northern Crawford Counties. Thunder and lightning were observed with this band and snowfall rates exceeded three inches per hour at times. The band moved slowly west during the predawn hours. Accumulations from midnight to daybreak on the 20th ranged from 8 to 14 inches over much of southern Erie and northern Crawford Counties. The snow finally tapered off during the afternoon hours after several more inches of accumulation. Some locations saw over two feet of snow during this two day event. Travel was severely hampered by this storm and dozens of accidents were reported.

7.28 **Landslide (Z).** The dislodging and fall of a mass of debris, earth, or rock, resulting in a fatality, injury, or damage. Mudslides will be entered as a landslide.

Beginning Time - When the debris, earth and rock mass started to descend.

Ending Time - When the debris, earth and rock mass ceased motion.

Direct Fatalities/Injuries

- ❑ People were struck by debris, earth or rocks.
- ❑ People killed or injured when a vehicle was struck by moving debris, earth or rocks.

Indirect Fatalities/Injuries

- ❑ People who ran into the mass of debris, earth and rocks in the road with a vehicle after the mass stopped moving.

Example:

COZ067 Teller County/Rampart Range/Pikes Peak
15 0620MST 1 1 Landslide
0630MST
A thunderstorm produced very heavy rain early in the morning over Ute Pass. A slide of large rocks and earth cascaded onto U.S. Highway 24 about 12 miles west-northwest of Colorado Springs. A large rock hit a moving vehicle and killed one of the occupants instantly. The driver was seriously injured. M36VE

7.29 **Lightning (C).** A sudden visible flash caused by an electrical discharge from a thunderstorm, resulting in a fatality, injury, and/or damage.

Fatalities and injuries directly related to lightning strikes will be included in *Storm Data*. Report the specific location (see Table 2), gender and age of fatalities. If reliable lightning-related damage reports (such as structural fires or loss of electrical power and/or communications) are available, they may be entered. Often, the preparer is unaware of a lightning incident unless it is reported by the broadcast or print media, or by a governmental or law enforcement agency. Therefore, extra effort, such as fostering contacts with the media, fire departments or other first responders, hospitals and medical examiner offices, is recommended to obtain such information.

Over the western states, lightning may start hundreds of wildfires in a single CWFA. In these cases, the preparer will have to limit the number of incidents appearing in *Storm Data* by arbitrarily setting a threshold value based on minimum burned acreage, or some other parameter. In other situations, lightning may cause a fire that ultimately leads to fatalities and/or injuries. In these cases, the fatalities and/or injuries will be classified as indirectly-related. Refer to Section 2.6 for additional information.

Beginning Time - Exact time of lightning strike(s).

Ending Time - Same as beginning time.

Direct Fatalities/Injuries

- ❑ Lightning directly struck a person, resulting in a fatality or injury.
- ❑ Lightning traveled along a structure or body of water, resulting in a fatality or injury.
- ❑ Lightning hit a tree and knocked it over, resulting in a fatality or injury.
- ❑ Lightning hit the ground or an object and traveled underground, resulting in a fatality/injury.

Indirect Fatalities/Injuries

- ❑ Any traffic accident that led to a fatality or injury, caused by traffic signals being out.
- ❑ Someone suffered a heart attack and died while removing or cleaning up debris caused by a lightning strike.
- ❑ Any fatality or injury caused by a lightning-initiated fire.

Example:

Tioga County

3 SW Tioga	**06 1900EST**	**1**	**10**	**Lightning**

A 26 year old male died when he was struck by lightning while boating on the Hammond Reservoir during a fishing contest. In addition, 10 other people suffered minor, lightning-related injuries that required medical treatment. At least another 20 individuals felt the lightning shock waves but did not require treatment. M26BO

7.30 **Marine Hail (M).** Hail 3/4 inch in diameter or larger, occurring over the waters and bays of the ocean, Great Lakes, Lake Okeechobee, or Lake Pontchartrain (those assigned specific Marine Forecast Zones), will be entered. Hail 3/4 inch in diameter or larger, occurring immediately along the shorelines (to a maximum distance of 1 mile inland) of the waters and bays of the ocean, Great Lakes, Lake Okeechobee, or Lake Pontchartrain (those assigned specific Marine Forecast Zones), should be entered as a Marine Hail event, especially if the storm moved out over the nearshore waters (reasonable to assume it maintained its strength). Hail of smaller size, causing damage to watercraft or fixed platforms, should be entered. A maximum hail size will be entered.

The use of WSR-88D Doppler radar intensities (dBZ values) cannot be used to infer that a thunderstorm was sufficiently strong enough to produce hailstones meeting or exceeding the criteria listed in the previous paragraph.

StormDat software permits only one event name for encoding severe and non-severe Marine Hail events. If hail diameters over water surfaces with an assigned marine zone number are equal to, or greater than, 3/4 inch, a Marine Hail event always will be encoded. It is recognized that a number of Marine Hail events will never be documented. Hail sizes equal to or greater than 3/4 inch will initiate the verification process for Marine Hail events.

If hailstones with diameters less than 3/4 inches result in fatalities, injuries, or damage, encoding a marine hail event is recommended. Encoded values of estimated or measured marine hail diameters below 3/4 inch (non-severe), regardless of extent and/or severity of fatalities, injuries, and property damage, will not initiate the verification process.

Refer to Table 6 in Section 7.18.1 in order to convert estimated hail sizes to measured values.

Beginning Time - When hail began.

Ending Time - When hail ended.

Direct Fatalities/Injuries

- ❏ Hail injured a boater.
- ❏ Wind-driven hail shredded the sail of a sail boat, causing the boat to overturn, drowning the boater.

Indirect Fatalities/Injuries

- ❏ A boater panicked in a hail storm and ran into a breakwater.

Examples:

ANZ230 Boston Harbor MA
10 1530EST 0 0 Marine Hail (1.00)
1532EST
A boater reported quarter-size hail.

LEZ149 Conneaut OH to Ripley NY
18 1604EST 0 0 5K Marine Hail (0.50)
1608EST
One-half-inch diameter hail driven by 30 knot (35 mph) winds damaged two sailboats near Erie, PA.

7.31 **Marine High Wind (M).** Non-convective, sustained winds or frequent gusts of 48 knots (55 mph) or more, resulting in a fatality, injury, or damage. These conditions would correspond to a "storm" situation (48 to 63 knots/55 to 73 mph), or a "hurricane-force" wind situation (64 knots or higher/74 mph or higher). A peak wind gust (estimated or measured) or maximum sustained wind value will be entered.

When these wind conditions are satisfied, a *Storm Data* event entry is required, and the preparer will indicate in the entry table whether the wind value represents a maximum sustained wind, or maximum wind gust. Depending on the choice, the software will place an S or G in front of the wind value that appears in the *Storm Data* publication. Additionally, the StormDat software program requires the preparer to indicate whether the wind gust value, or sustained wind value, is measured or estimated. Refer to Sections 7.23 and 7.38 for related information.

Events with winds less than the above threshold numbers, resulting in fatalities, injuries, or property damage, will be encoded as a "marine strong wind" event. Similar to the marine high wind event, the preparer will indicate whether the marine strong wind event is based on a maximum wind gust or maximum sustained wind value.

The preparer can use high wind events occurring immediately along the shorelines (to a maximum distance of 1 mile inland) of the waters and bays of the ocean, Great Lakes, Lake Okeechobee, or Lake Pontchartrain (those assigned specific Marine Forecast Zones), to infer that a Marine High Wind event occurred over the near-shore waters (reasonable to assume its strength was maintained over water).

Beginning Time - When the wind started to cause a fatality, injury, or damage.

Ending Time - When the wind no longer caused a fatality, injury, or damage.

Direct Fatalities/Injuries

- ❑ Fatalities or injuries caused by falling or airborne debris associated with structural failure of a marine vessel due to wind.
- ❑ Fatalities resulting from drowning due to an overturned, damaged, or destroyed marine vessel.

Indirect Fatalities/Injuries

- ❑ Fatalities or injuries when a marine vessel collided with debris on the water surface left over from a previous wind or storm event.
- ❑ Any fatalities or injuries incurred during the clean-up process.
- ❑ Fatalities or injuries associated with making contact with power lines after they fell.
- ❑ Any fatalities or injuries from loss of electrical power, including lack of heat, cooling, or light, or failure of equipment.

Example:

LMZ643- Sheboygan to Pt Washington
9 E Oostburg 04 1200CST 4 0 300K Marine High Wind (G61)[M]
2100CST

Strong, powerful, southwest winds behind a cold front persisted for about 9 hours over central Lake Michigan. The winds capsized a luxury cruise boat east of Oostburg in the open waters. Four people drowned inside the boat as it flipped over due to estimated waves of 8 to 12 feet. The boat sustained major structural damage. M57BO F50BO M65BO F66BO

7.32 **Marine Strong Wind (M).** Non-convective, sustained winds or frequent gusts up to 47 knots (54 mph), resulting in a fatality, injury, or damage. Wind speed values of 34 to 47 knots (39 to 54 mph) would correspond to a “gale” situation. A peak wind gust (estimated or measured) or maximum sustained wind value will be entered. Refer to Sections 7.38 and 7.39 for related information.

The preparer can use strong wind events occurring immediately along the shorelines (to a maximum distance of 1 mile inland) of the waters and bays of the ocean, Great Lakes, Lake Okeechobee, or Lake Pontchartrain (those assigned specific Marine Forecast Zones), to infer that a Marine Strong Wind event occurred over the near-shore waters (reasonable to assume its strength was maintained over water).

Beginning Time - When the wind started to cause a fatality, injury, or damage.

Ending Time - When the wind no longer caused a fatality, injury, or damage.

Direct Fatalities/Injuries

- ❑ Fatalities or injuries caused by falling or airborne debris associated with structural failure of a marine vessel due to wind.
- ❑ Fatalities resulting from drowning due to an overturned, damaged, or destroyed marine vessel.

Indirect Fatalities/Injuries

- ❏ Fatalities or injuries when a marine vessel collided with debris on the water surface left over from a previous wind or storm event.
- ❏ Any fatalities or injuries incurred during the clean-up process.
- ❏ Fatalities or injuries associated with making contact with power lines after they fell.
- ❏ Any fatalities or injuries from loss of electrical power, including lack of heat, cooling, or light, or failure of equipment.

Example:

LMZ665-	**Sheboygan to Pt Washington**					
3 E Oostburg	**31**	**0600CST 1800CST**	**1**	**1**	**10K**	**Marine Strong Wind (G40)**

Strong, gusty southwest winds behind a cold front persisted for about 12 hours over central Lake Michigan. The winds capsized a small boat east of Oostburg in the near-shore waters. One person drowned after they were thrown into the water, and one person was injured as the boat flipped over due to estimated waves of 5 to 8 feet. The boat sustained minor structural damage. M27IW

7.33 **Marine Thunderstorm Wind (M).** Winds, associated with thunderstorms, occurring over the waters and bays of the ocean, Great Lakes, Lake Okeechobee, or Lake Pontchartrain (those assigned specific Marine Forecast Zones), with speeds of at least 34 knots (39 mph) expected to occur for 2 hours or less, or winds of any speed that result in a fatality, injury, or damage to watercraft or fixed platforms. Similar thunderstorm winds occurring immediately along the shorelines (to a maximum distance of 1 mile inland) of the waters and bays of the ocean, Great Lakes, Lake Okeechobee, or Lake Pontchartrain (those assigned specific Marine Forecast Zones), should be entered as a Marine Thunderstorm Wind, especially if the storm then moved out over the nearshore waters (reasonable to assume it maintained its strength). Marine thunderstorm winds must occur within 45 minutes before or after lightning is observed or detected.

The use of WSR-88D Doppler radar intensities (dBZ values) cannot be used to infer that a thunderstorm was sufficiently strong enough to produce wind gusts meeting or exceeding the criteria listed in the previous paragraph.

StormDat software permits only one event name for encoding severe and non-severe “marine thunderstorm winds.” Maximum wind gusts (measured or estimated) equal to or greater than 34 knots (39 mph) always will be entered. Values less than 34 knots (39 mph) should be entered only if they result in fatalities, injuries, or property damage.

Note that damage alone does not automatically imply wind speeds of 34 knots (39 mph) or greater. When estimating a wind speed value, the preparer should take into account the amount and degree of severity, and condition of the damaged property. The resultant damage must support such a value. Refer to Table 9 in Section 7.39.4 for guidelines on estimating wind speeds. Estimated or measured wind gusts below 34 knots (39 mph), regardless of extent and/or severity of fatalities, injuries, and property damage, will not initiate the verification process. Wind values of 34 knots (39 mph) or more will initiate the verification process for Marine Thunderstorm Wind events.

Beginning Time - When winds of 34 knots or greater first occurred or when a fatality, injury, or damage began.

Ending Time - When winds diminished to less than 34 knots or when reports of fatalities, injuries, or damage were no longer received.

Direct Fatalities/Injuries

- ❏ A wind gust, associated with a thunderstorm, overturned a canoe and the canoeist drowned.
- ❏ A jet-skier, jumping large waves created by thunderstorm winds, was killed when the craft flipped over.
- ❏ A thunderstorm-generated wave hit a boat broadside, and a boater lost his balance, fell overboard and drowned.

Indirect Fatalities/Injuries

- ❏ Thunderstorm winds uprooted a tree that fell in the water. An hour later, a water skier ran into the tree and was killed.

Examples:

ANZ531 **Chesapeake Bay from Pooles Island to Sandy Point MD**
10 1530EST 1 0 Marine Tstm Wind (G25)
1532EST
A one-person catamaran sailing in Chesapeake Bay just offshore Sandy Point State Park capsized when an estimated wind gust of 25 knots (30 mph), generated by a thunderstorm, caught it broadside. The sailor drowned after hitting his head on the mast and being thrown into the water. M20IW

LMZ741 **Wilmette Harbor to Meigs Field IL**
18 1604CST 0 0 Marine Tstm Wind (G42)[M]
1606CST
A squall line moved through the Chicago area and off the lakefront. A peak gust to 42 knots (48 mph) was recorded at the Harrison Street Crib.

7.34 **Rip Current (Z).** A narrow channel of water flowing seaward from the beach, through the surf zone and beyond the breaking waves, occurring over the waters and bays of the ocean, Great Lakes, Lake Okeechobee or Lake Pontchartrain (those assigned specific Marine Forecast Zones). They often form when the gradient wind is strong and directly onshore or when swell from a distant extra-tropical or tropical cyclone impinge on the coast. Rip currents will only be listed in *Storm Data* when they cause drowning, near-drowning, rescues, or damage to shoreline property or watercraft. A current not directly associated with winds or waves, such as those associated with tidal currents, or other currents such as long-shore currents, will not be included in *Storm Data* as Rip Current events.

Beginning Time - The time when a rip current drowning, near-drowning, or rescue incident began or damage began.

Ending Time - The time that the rip current drowning, near-drowning, or rescue incident ended or damage ended.

Direct Fatalities/Injuries
- ❑ A fatality due to a drowning from a rip current that was caused by wind or wave activity.
- ❑ A near-drowning due to a rip current that required medical treatment (either on-site or at a hospital) is considered an injury.

Indirect Fatalities/Injuries
- ❑ None

Examples:

FLZ072 **Coastal Waters from Deerfield Beach to Ocean Reef FL**
25 1400EST 1 1 Rip Current
1630EST
A 78-year old tourist swimming in the Atlantic behind his condominium near Fort Lauderdale drowned in a rip current. The beach patrol rescued four others, one of whom was transported to the hospital for medical treatment. M78IW

CAZ042 **Inner Waters from Pt. Mugu to San Mateo Pt CA**
05 0900PST 2 2 Rip Current
1600PST
A 25-year-old male and a 24-year-old female drowned in a rip current near a pier at Huntington Beach. Lifeguards made over two dozen rescues with two near-drowning as 10-foot swells from Hurricane Angelo swept north. M25IW, F24IW

7.35**.** **Seiche (Z).** A standing-wave oscillation in any enclosed lake which continues after a forcing mechanism has ceased and results in shoreline flooding and/or damage. In the Great Lakes and large inland lakes, large pressure differences, high winds, or fast-moving squall lines may act as the forcing mechanism. In addition, earthquakes or landslides can initiate a seiche. When the forcing mechanism ends, the water sloshes back and forth from one end of the lake to the other, causing water level fluctuations of up to several feet before damping out.

Beginning Time - When water levels rose to initiate shoreline flooding.

Ending Time - When water returned to pre-seiche levels.

Direct Fatalities/Injuries
- ❑ Persons near shore were swept away by the large wave and drowned.
- ❑ A boat was overturned by the large wave, drowning those on board.
- ❑ A structure was damaged or flooded by the wave killing those inside.

Indirect Fatalities/Injuries

- ❏ Person died when cleaning up seiche-generated debris after the seiche ended.
- ❏ Person died from a building that collapsed from beach erosion after a seiche ended.

Example:

MIZ071 Van Buren
28 0300EST 0 0 250K Seiche
0315EST
An early morning seiche of 3 feet caused by a thunderstorm squall line that crossed Lake Michigan, caused damage in western Lower Michigan. The rising water damaged boats and docks at South Haven. At least $250,000 in damage occurred along the shoreline.

7.36 **Sleet (Z).** Sleet accumulations meeting or exceeding locally defined warning criteria (typical value is ½ inch or more). The *Storm Data* preparer should include in the narrative the time that sleet began to accumulate.

Beginning Time - When sleet accumulations equaled regionally/locally established warning threshold values, or as inferred by damage reports.

Ending Time - When sleet accumulation ended.

Direct Fatalities/Injuries

- ❏ The weight of sleet on a roof or other structure causes it to collapse, killing someone. (Rare)

Indirect Fatalities/Injuries

- ❏ Any automobile-related accident due to sleet accumulation or poor driving conditions.
- ❏ Any fatality or injury related to someone falling or slipping on sleet.

Example:

WYZ015-062 Natrona - North Carbon
03 1400MST 0 0 65K Sleet
04 0200MST
Sleet began accumulating around 1200 MST on the 3rd. Accumulations eventually reached as much as 8 inches in the central foothills of Wyoming, causing extensive ice conditions and drifts of sleet. Driving was hazardous at best with numerous accidents along Highway 54. The slippery road surface resulted in one accident involving two trucks in which four people were injured (indirectly).

7.37 **Storm Surge/Tide (Z).** For coastal and lakeshore areas, the vertical rise above normal water level associated with a storm of tropical origin (e.g., hurricane, typhoon, or tropical storm) caused by any combination of strong, persistent onshore wind, high astronomical tide and low atmospheric pressure, resulting in damage, erosion, flooding, fatalities, or injuries. **Coastal flooding not associated with a typhoon, hurricane, or tropical storm should be reported under the Coastal Flooding category.**

For coastal areas, normal water level is defined as mean sea level. Basically, storm tide is the sum of storm surge and astronomical tide. If the astronomical tide height for the flooded area is known, it should be subtracted from the total water level/storm tide (runup/debris line), and the result specifically labeled in the narrative as "storm surge." The method of measuring surge height should be mentioned in the narrative, e.g. "NWS survey team calculated a surge height of 4 feet by subtracting the astronomical tide height from the runup/debris line height."

Coastal and lakeshore areas are defined as those portions of coastal land zones (coastal county/parish) adjacent to the waters and bays of the oceans, Great Lakes, Lake Okeechobee, and Lake Pontchartrain. Further inland, the *Storm Data* preparer must determine when and where to encode a flood event as Flash Flood or Flood. Terrain (elevation) features will determine how far inland the coastal/lakeshore flooding extends.

Beginning Time - When the water level began to cause damage or flooding.

Ending Time - When the water level dropped to a point where damage or flooding ended.

Direct Fatalities/Injuries
- ❏ A coastal dwelling was washed away injuring/killing the occupants.
- ❏ A person drowned when a vehicle was swept away by the storm tide.

Indirect Fatalities/Injuries
- ❏ A person suffered a heart attack while evacuating from a storm tide.
- ❏ A person died in a vehicle accident caused by the storm tide washing away a traffic signal.
- ❏ A person died in a vehicle accident after losing control in standing water on a road.

Example:

FLZ041-047- Volusia - Brevard - Indian River - St. Lucie - Martin
054-059-064

25 2200EST 0 0 8M Storm Surge/Tide
26 1600EST

The greatest storm tides occurred between Brevard and St. Lucie Counties, to the right of the land-falling eye-wall of Hurricane Jeanne. Initial estimates of storm tide ranged from 7 feet in Volusia County to around 11 feet in St Lucie County. Storm surge heights for those areas ranged respectively from 6 to 10 feet, as determined by NWS survey teams that subtracted a 1 foot astronomical tide height from debris line heights. Damage would have been greater except that Jeanne came ashore during low tide. Hardest hit was the town of New Smyrna Beach where much of the sand east of the town's seawall was removed.

7.38 **Strong Wind (Z).** Non-convective winds gusting less than 50 knots (58 mph), or sustained winds less than 35 knots (40 mph), resulting in a fatality, injury, or damage. Consistent with regional guidelines, mountain states may have higher criteria. A peak wind gust (estimated or measured) or maximum sustained wind will be entered.

The Strong Wind event name will be used for wind damage reports from inland counties/parishes that experienced the effects of tropical depressions. Refer to Section 7.41 for additional details.

Events over large inland lakes (with no specific, assigned Marine Forecast Zone number) that meet strong wind criteria will be entered as a Strong Wind event, rather than a Marine Strong Wind event.

Beginning Time - When the wind started to cause a fatality, injury, or significant damage.

Ending Time - When the wind no longer caused a fatality, injury, or significant damage.

Direct Fatalities/Injuries

- ❑ Fatalities or injuries caused by falling debris associated with structural failure (includes falling trees, utility poles, and power lines).
- ❑ Fatalities or injuries associated with vehicles that were blown over, or with vehicles that were blown into a structure or other vehicles.
- ❑ Fatalities or injuries caused by airborne objects striking people or vehicles.
- ❑ Drowning due to boats capsizing from wind on inland lakes without an assigned Marine Forecast Zone.

Indirect Fatalities/Injuries

- ❑ Fatalities or injuries when a vehicle collided with debris scattered on a roadway.
- ❑ Any fatalities or injuries incurred during the clean-up process.
- ❑ Fatalities or injuries associated with making contact with power lines after they fell.
- ❑ Any fatalities or injuries from loss of electrical power, including lack of heat, cooling, or light, or failure of medical equipment.

Example:

TXZ252-253- Starr - Hidalgo - Cameron
255 22 1000CST 1 0 15K Strong Wind (G45)[M]
2100CST

Gusty winds to 45 knots (52 mph) occurred in the Rio Grande Valley of Deep South Texas behind a passing cold front. Power lines and store signs were downed in Rio Grande City, Mercedes, and Brownsville. A large store sign fell on a passing car on US 281 in Brownsville, killing the driver. M27VE

7.39 **Thunderstorm Wind (C).** Winds, arising from convection (occurring within 30 minutes of lightning being observed or detected), with speeds of at least 50 knots (58 mph), or winds of any speed (non-severe thunderstorm winds below 50 knots) producing a fatality, injury, or damage. Maximum wind gusts (measured or estimated) equal to or greater than 50 knots (58 mph) will always be entered. Events with maximum wind gust values less than 50 knots (58 mph) should be entered as a *Storm Data* event only if they result in fatalities, injuries, or serious property damage. StormDat software permits only one event name for encoding severe and non-severe thunderstorm winds. The StormDat software program requires the preparer to indicate whether the wind gust value was measured or estimated.

Note: “Extreme” damage is defined as thunderstorm winds greater than 64 knots (74 mph), equivalent to estimated winds in the F1 category of the Fujita damage scale. Therefore, partial roofs removed, windows broken, light trailer homes pushed over/overturned, automobiles pushed off the road would be considered extreme wind damage. Also refer to Table 9 in Section 7.39.4 for guidance.

7.39.1 Downbursts. Downbursts, including dry or wet microbursts or macrobursts, will be classified as Thunderstorm Wind events. In some cases, the downburst may travel several miles away from the parent thunderstorm, or the parent thunderstorm may have dissipated. However, since the initiation of the downburst event was related to a thunderstorm, Thunderstorm Wind is the appropriate event to use.

7.39.2 Gustnadoes. A gustnado is a small and usually weak whirlwind which forms as an eddy in thunderstorm outflows. They do not connect with any cloud-base rotation and are not tornadoes. Since their origin is associated with cumuliform clouds, gustnadoes will be classified as Thunderstorm Wind events.

7.39.3 Thunderstorm Wind Damage. Note that damage alone does not automatically imply wind speeds of 50 knots (58 mph) or greater. When estimating a wind speed value, the preparer should take into account the amount and degree of severity, and condition of the damaged property (age, type of construction technique used, exposure, topography, soil moisture/ composition, and local wind funneling effects due to orientation/closeness of other objects). The resultant damage must support such a value. Refer to Table 7 in Section 7.39.4 for guidelines on estimating wind speeds. Estimated or measured wind gusts below 50 knots (58 mph), regardless of extent and/or severity of fatalities, injuries, and property damage, will not initiate the verification process. Encoded wind values of 50 knots (58 mph) or more will initiate the verification process for Thunderstorm Wind events.

The *Storm Data* preparer must use professional judgment to determine the estimated maximum wind value based on observed structural or tree damage. For example, a rotted tree that is toppled by thunderstorm winds would not support an estimated wind gust of 50 knots (58 mph). On the other hand, numerous large trees, power lines, and road signs toppled by high winds would support an estimated gust value over 50 knots (58 mph).

The preparer should note in the *StormDat* program whether the thunderstorm wind (gust) was measured (MG), estimated (EG), measured sustained (MS), estimated sustained (ES), or unknown.

Beginning Time - When damage first occurred or winds 50 knots (58 mph) or greater were first reported.

Ending Time - When damage ended or winds of 50 knots (58 mph) were last reported.

Direct Fatalities/Injuries

- ❑ A thunderstorm wind gust snapped a large tree limb. The limb fell on a passing car, killing or injuring the driver.

Indirect Fatalities/Injuries

- ❑ A wind gust snapped a large tree limb which fell on the road. A few minutes later a car drove into the tree limb and the driver was killed or injured.
- ❑ A wind gust downed numerous trees and limbs. The next morning a person cleaning up the debris in his yard died or was injured from a chainsaw accident.
- ❑ A thunderstorm gust toppled a tree on a home's gas meter which exploded. The resultant fire subsequently killed two people who were in the home.

Examples:

El Paso County
Colorado Spgs 23 1730MST 0 0 Thunderstorm Wind (G70)^{M}

Thunderstorm winds estimated at 75 mph downed numerous large trees, ripped off several barn roofs, and blew over a fuel storage tank. Two people were injured (indirectly related) when their vehicle struck a large tree on a road about 1 hour after the storm ended.

DeKalb County
Malta 12 1505CST 0 0 15K 10K Thunderstorm Wind (G65)

A small, dry-microburst struck the 5100 block of North Nevada Avenue in Colorado Springs. The downburst winds tore down power lines (but left the poles standing), ripped 40 square feet of roofing off a building, blew a pontoon boat 30 feet off its trailer, damaged billboards, and brought down tree limbs 6 to 8 inches in diameter.

Langlade County
Antigo 10 1309CST 0 0 3K Thunderstorm Wind (G45)^{M}

A wind gust from a thunderstorm blew a home-built aircraft onto its side, resulting in damage to the airplane.

Waukesha County
Genesee 15 1915CST 0 0 50K Thunderstorm Wind (G50)

A gustnado along the leading edge of a downburst produced wind gusts estimated at nearly 60 mph, damaging a barn and farm house along Highway 59 near Genesee. Interaction between the downburst and outflow from another thunderstorm just south of the city of Waukesha generated the gustnado.

7.39.4 Table for Estimating Wind Speed from Damage.

Wind Speed	Observations
26-38 kts (30-44 mph)	Trees in motion. Light-weight loose objects (e.g., lawn furniture) tossed or toppled.
39-49 kts (45-57 mph)	Large trees bend; twigs, small limbs break, and a few larger dead or weak branches may break. Old/weak structures (e.g., sheds, barns) may sustain minor damage (roof, doors). Building partially under construction may be damaged. A few loose shingles removed from houses. Carports may be uplifted; minor cosmetic damage to mobile homes and pool lanai cages.
50-64 kts (58-74 mph)	Large limbs break; shallow rooted trees pushed over. Semi-trucks overturned. More significant damage to old/weak structures. Shingles, awnings removed from houses; damage to chimneys and antennas; mobile homes, carports incur minor structural damage; large billboard signs may be toppled.
65-77 kts (75-89 mph)	Widespread damage to trees with trees broken/uprooted. Mobile homes may incur more significant structural damage; be pushed off foundations or overturned. Roof may be partially peeled off industrial/commercial/ warehouse buildings. Some minor roof damage to homes. Weak structures (e.g., farm buildings, airplane hangars) may be severely damaged.
78+ kts (90+ mph)	Many large trees broken and uprooted. Mobile homes severely damaged; moderate roof damage to homes. Roofs partially peeled off homes and buildings. Moving automobiles pushed off dry roads. Barns, sheds demolished.

Table 9. Estimating Wind Speed from Damage.

<u>Note</u>: All references to trees are for trees with foliage. Appreciably higher winds may be required to cause similar damage to trees without foliage. In addition, very wet soil conditions may allow weaker winds of 26 to 49 knots (30 to 57 mph) to uproot trees.

7.39.5 <u>Knots-Mile Per Hour Conversion Tables</u>. Tables 10 and 11 will assist in conversion of wind speed values between knots and miles per hour.

KTS	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	5	6	7	8	9	10
10	12	13	14	15	16	17	18	20	21	22
20	23	24	25	26	28	29	30	31	32	33
30	35	36	37	38	39	40	41	43	44	45
40	46	47	48	49	51	52	53	54	55	56
50	58	59	60	61	62	63	64	66	67	68
60	69	70	71	72	74	75	76	77	78	79
70	81	82	83	84	85	86	87	89	90	91
80	92	93	94	96	97	98	99	100	101	102
90	104	105	106	107	108	109	110	112	113	114

Table 10. Knots to miles per hour. (Example: 45 knots equals 52 mph)

MPH	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	3	4	5	6	7	8
10	9	10	10	11	12	13	14	15	16	17
20	17	18	19	20	21	22	23	23	24	25
30	26	27	28	29	30	30	31	32	33	34
40	35	36	36	37	38	39	40	41	42	43
50	43	44	45	46	47	48	49	49	50	51
60	52	53	54	55	56	56	57	58	59	60
70	61	62	63	63	64	65	66	67	68	69
80	70	70	71	72	73	74	75	76	76	77
90	78	79	80	81	82	83	83	84	85	86

Table 11. Miles per hour to knots. (Example...45 mph equals 39 knots)

7.39.6 Speed-Distance Conversion Table. On occasion, the *Storm Data* preparer may need to calculate beginning and ending times, time of arrival, or validity of storm report times, based on a known thunderstorm speed from radar. To assist in this task, use Table 12.

KTS/MPH	1 Mile in X Minutes	KTS/MPH	1 Mile in X Minutes
52/60	1 mile in 1.0 min	**26/30**	1 mile in 2.0 min
48/55	1 mile in 1.1 min	**22/25**	1 mile in 2.4 min
43/50	1 mile in 1.2 min	**17/20**	1 mile in 3.0 min
39/45	1 mile in 1.3 min	**13/15**	1 mile in 4.0 min
35/40	1 mile in 1.5 min	**9/10**	1 mile in 6.0 min
30/35	1 mile in 1.7 min	**4/5**	1 mile in 12.0 min

Table 12. Speed to Distance Conversion.

7.40 **Tornado (C).** A violently rotating column of air, extending to or from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud. Literally, in order for a vortex to be classified as a tornado, it must be in contact with the ground and extend to/from the cloud base, and there should be some semblance of ground-based visual effects such as dust/dirt rotational clouds, or structural or vegetative damage or disturbance.

The tornado path length will be entered in miles and tenths of a mile. The maximum tornado path width will be entered in yards. Also a Fujita Damage scale will be entered. The tornado path length generally excludes sections without surface damage/disturbance, unless other evidence of the touchdown (e.g., a trained spotter report, videotape of the tornado over a plowed field, etc.) is available. The excluded section will generally not exceed 2 continuous miles or 4 consecutive minutes of travel time; otherwise, the path will be categorized as consisting of separate Tornado events. The beginning and ending locations of the excluded sections should be described as accurately as possible in the narrative. Professional judgment must be exercised in determining the existence of separate tornadoes. Each and every case is a different situation.

Path width in the entry header is the maximum width, in yards, over the entire path, or of each segment in a multi-segment tornado. It is very desirable to include the average path width in the narrative, especially for significant tornadoes, since this value may be more meaningful or useful in some scientific studies.

If possible to determine, it is very desirable to include in the narrative the type of thunderstorm that was associated with the tornado, such as high-precipitation supercell, low precipitation supercell, non-supercell thunderstorm, line thunderstorm, bookend vortex, etc.

When discernable, wind damage from the rear flank downdraft should not be considered part of the tornado path but should be entered as a Thunderstorm Wind event.

Gustnadoes will be reported as Thunderstorm Wind events. Refer to Section 7.39.2 for details.

Landspouts and cold-air funnels, ultimately meeting the objective tornado criteria listed in Section 7.39.6, will be classified as Tornado events.

7.40.1 Tornado, Funnel Cloud, and Waterspout Events. The terms Tornado, Funnel Cloud, and Waterspout are defined below.

a. Tornado. A violently rotating column of air extending from a cumuliform cloud or underneath a cumuliform cloud, to the ground, and often (but not always) visible as a condensation funnel. Literally, in order for a vortex to be classified as a tornado, it must be in contact with the ground and extend to/from the cloud base. On a local scale, it is the most destructive of all atmospheric phenomena.

b. Waterspout. A violently rotating column of air usually pendant to a cumulus/ cumulonimbus, over a body of water, with its circulation reaching the water.

c. Funnel Cloud. A rotating visible extension of cloud pendant to a cumulus/ cumulonimbus with circulation not reaching the ground or water.

In some situations, many public and spotter reports of funnel clouds are passed on to a WFO. In these cases, the preparer should document only the most significant funnel clouds, especially those that generate public or media attention.

WFOs are responsible for identifying, investigating, and confirming storms occurring in their warning areas. To accomplish this, the *Storm Data* preparer should use all available severe weather reports, including information from newspapers, letters and photographs, airborne surveys and pilot reports, state/local emergency management, and personal inspections.

When available information includes a reliable report that a tornado vortex was distinctly visible (condensation funnel pendant from a cloud - usually a cumulonimbus), and in contact with the ground, or a rotating dust/dirt/debris column at the ground is overlaid with a condensation funnel cloud pendant above, identification of a tornado is a simple matter. This is particularly true when reports have been investigated by the responsible NWS official and found to be reliable. However, tornadoes, funnel clouds, and waterspouts can be hidden by precipitation, low clouds, or dust. Darkness or lack of observers also may result in a tornado or waterspout not being observed. The WFO must exercise professional judgment to identify a tornado or waterspout from its effects.

7.40.2 Criteria for a Waterspout. A vortex in contact with the water surface that develops on, or moves over, the waters and bays of the oceans, Great Lakes, Lake Okeechobee, or Lake Pontchartrain (assigned Marine Forecast Zones) will be characterized as a Waterspout for that portion of its path over those water surfaces. The vortex will be classified as a Tornado for that portion of its path over land or inland bodies of water that are not assigned Marine Forecast Zones. Refer to Section 7.44 for additional waterspout details.

7.40.3 Tornadoes Crossing CWFA Boundaries. Tornadoes crossing state lines or boundaries of WFO CWFA responsibility will be coordinated between WFOs. The preparer will ensure that the exact location, where a tornado crosses a county, parish, or state line, is incorporated into the narrative. Sharp-turning tornadoes may need to be segmented into individual pieces in order to adequately describe the path of that event. However, segmenting a tornado within the same county/parish is not allowed since this practice may lead to confusion and over-counting of tornadoes by the Storm Prediction Center and *Storm Data* users. It is recommended that the preparer encode only one beginning and ending point for the tornado path within each county/parish affected, and provide detailed information in the narrative about the intermediate locations where the tornado turned sharply. Additional instructional information regarding these "border-crossing" tornadoes can be found in the Tornado event examples in this Section.

7.40.4 Landspouts and Dust Devils. A landspout (slang term for non-supercell tornado) will be classified as a Tornado, assuming the preparer has reliable reports meeting the criteria outlined in Section 7.40.6. Similarly, cold-air funnels, meeting the criteria outlined in Section 7.40.6, will be classified as a Tornado event.

On the other hand, dust devils will not be classified as tornadoes since they are a ground-based whirlwind that doesn't meet the tornado criteria outlined in Section 7.40.6. A Dust Devil is an allowable *Storm Data* event name as indicated in Section 7.9.

7.40.5 On-site Inspections (Surveys). WFO tornado/waterspout and significant downburst damage surveys are desirable in those cases when the Meteorologist in Charge (MIC) or Warning Coordination Meteorologist believes additional information is needed for *Storm Data* preparation. A survey should be done as soon as possible before clean-up operations remove too much damage evidence.

7.40.6 Objective Criteria for Tornadoes. An event will be characterized as a tornado if the type or intensity of the structural and vegetative damage and/or scarring of the ground only could have been tornadic, or if any two of the following guidelines are satisfied:

a. Fairly well-defined lateral boundaries of the damage path;

b. Evidence of cross-path wind component, e.g., trees lying 30 degrees or more to the left/right of the path axis (suggesting the presence of a circulation);

c. Evidence of suction vortices, ground striations, and extreme missiles; or

d. Evidence of surface wind convergence as suggested by debris-fall pattern and distribution. In fast-moving storms, the convergence pattern may not be present and debris pattern may appear to fall in the same direction.

Additionally, an event will be characterized as a tornado if:

a. Eyewitness reports from credible sources, even with little or no structural or vegetative damage, and/or little or no scarring of the ground, indicate that a violent circulation extended from the convective cloud base to the ground; or

b. Videotapes or photographs from credible sources, even with little or no structural or vegetative damage, and/or little or no scarring of the ground, indicate that a violent circulation extended from the convective cloud base to the ground.

There may be situations, especially in the central or western parts of the United States, where verification of tornadoes will be difficult. However, if available evidence establishes that it was highly likely a Tornado event occurred, the preparer will enter the event in *Storm Data*.

7.40.7 Determining Path Length and Width. Path length (in miles and tenths of miles) and maximum path width (in yards) will be indicated for all tornadoes, including each member of families of tornadoes, or for all segments of multi-segmented tornadoes. The length in the header strip is the length of that particular segment in that particular county/parish. The Storm Prediction Center or a *Storm Data* user can determine the entire length of a multi-segmented tornado by adding the lengths from each segment as well as using the latitude and longitude of that segment. Note that latitude and longitude is not available in the *Storm Data* publication, but is available on the internet by National Climatic Data Center and the Storm Prediction Center database.

Path length generally excludes sections without surface damage or burn marks, unless other evidence of a ground-based circulation exists, e.g., a trained spotter report, or a videotape of the tornado over a plowed field. The excluded section, as a guideline, will generally not exceed 2 continuous miles or 4 consecutive minutes of travel time. In some cases, careful analysis will determine if separate tornadoes actually occurred within 2 miles or 4 minutes. Otherwise, the path will be categorized as consisting of separate Tornado events. Refer to Section 7.40.9 for related information. Use the narrative to describe whether a tornado skipped or was continuous in these types of cases.

The width in the header strip is the maximum observed through the entire length of a tornado, or of each segment in a multi-segment tornado. Generally, in the absence of structural damage, broken small tree branches of at least 3 inches in diameter can be considered as a marker for tornado width (assuming this damage isn't related to the rear flank downdraft). In arid regions where there is a lack of trees, other vegetation or landscape material will have to be used as a marker. To determine the tornado's maximum width, the Storm Prediction Center or *Storm Data* user must check each segment which is entered as a separate event.

The preparer is encouraged to include in the narrative the average path width (in yards) of all tornadoes. Availability of average path width information in *Storm Data* benefits the scientific research community and other users.

7.40.8 Determining F-Scale Values. The F-scale values will be assigned to every documented tornado. The *Storm Data* preparer must exercise professional judgment to determine the F-scale rating. Eyewitness verbal accounts, newspaper or personal photographs, and videotapes of the tornado(s) may be relied upon when an inspection/survey is not possible. In cases where there is damage to numerous structures, damage to a single structure should not be used as the deciding factor for the appropriate F-scale rating. Experience has shown that the F-scale of a tornado cannot be determined, consistently and reliably, solely on appearance. Due to the difficulty in judging the F-scale, the assigned value may vary by +/- 1 in F-Scale value.

To assist the WFO, uniform objective guidelines are listed in Table 11 in Section 7.40.13, and Table 12 in Section 7.409.14, followed by pictures of related damage. These tables and damage pictures correlate observed structural damage with types of construction and the resultant F-scale value. Additionally, Table 9 in Section 7.39.4 may be of assistance.

7.40.9 Simultaneously Occurring Tornadoes. On occasions, especially over the Plains States, a single cumulonimbus may have several, separate, tornadoes occurring simultaneously. They may be separated by a distance as little as ½ to 1 mile; and each may have a distinct, separate trajectory. In these cases, the Storm Data preparer should classify the tornadoes as separate events, each with a unique start/end location/time combination. The preparer will have to rely on credible evidence such as eyewitness reports, videotapes, and damage along the path in order to determine how many tornadoes actually existed. Existing *Storm Data* indicates that "landspout" tornadic situations have resulted in several simultaneously occurring tornadoes.

If evidence suggests that a multiple-vortex tornado occurred, the *Storm Data* preparer will document this situation as a single tornado event, even though each vortex created a distinct damage path. The multiple vortices rotate around a common center—the tornado center. Conversely, separate tornadoes, even if they are closely spaced, will not rotate around a common center.

A brief detailed explanation of simultaneously occurring tornadoes can be included in the narrative associated with each tornado event.

Beginning Time - When the tornado first contacted the ground.

Ending Time - When the tornado lost contact with the ground.

Direct Fatalities/Injuries
- ❑ Structures or trees were blown over and landed on someone, resulting in a fatality/injury.
- ❑ People became airborne and struck the ground or objects, resulting in a fatality/injury.
- ❑ High voltage power lines were blown onto a car, killing or injuring those inside.
- ❑ A high-profile vehicle was blown over, resulting in a fatality/injury.
- ❑ A vehicle was blown into a structure or oncoming traffic, resulting in a fatality/injury.
- ❑ Objects became airborne (debris, missiles), resulting in a fatality/injury.
- ❑ A boat on an inland lake or river was blown over or capsized, resulting in a drowning.

Indirect Fatalities/Injuries
- ❑ A person was killed or injured after running into a tree downed by the tornado.
- ❑ Someone was electrocuted by touching downed power lines.
- ❑ Someone suffered a heart attack and died as a result of removing debris.

7.40.10 Single-Segment (Non Border-crossing) Tornado Entries.

7.40.10.1 Example of a Tornado Within One County/Parish.

Page County

Bingham to	**22**	**1905CST**	**6**	**75**	**0**	**0**	**5K**	**5K**	**Tornado (F1)**
2 NE Norwich		**1917CST**							

At 1905 CST, a tornado touched down near Bingham, and moved east to Norwich before lifting off the ground 2 miles northeast of Norwich. Two homes in Bingham and one in Norwich sustained minor damage. The tornado track was not continuous; there were two areas (both about one-half-mile long) east of Bingham where damage was not discernable. Average path width was 30 yards.

7.40.10.2 Example of a Tornado that Changed Direction Within One County/Parish. A tornado that affects only one county/parish should be entered as only one segment, even if the tornado changed direction within a county/parish. The end points should be entered in the heading and the complete description of the tornado's path, including any variation from a straight line, should be described in the narrative.

Jackson County									
5 W Vernon to 5 NNE Vernon	**14**	**2308CST 2326CST**	**10**	**150**	**0**	**0**	**150K**		**Tornado (F1)**

A tornado touched down 5 miles west of Vernon. The tornado moved east through the city of Vernon, and then veered left at the center of the city. It finally dissipated about 5 miles north-northeast of town. Trees and power lines were blown down and several barns were damaged. A business and a home were partially unroofed in Vernon. Based on damage, the tornado winds were around 83 knots (95 mph). Average path width was 75 yards.

7.40.10.3 Example of a Tornado over an Inland Body of Water (Without an Assigned Marine Forecast Zone).

Davis County									
7SW Layton	**01**	**1738MST 1741MST**	**1**	**30**	**0**	**0**			**Tornado (F0)**

State Police spotted a tornado over Great Salt Lake. It dissipated before reaching shore.

7.40.10.4 Examples of a Tornado that Became a Waterspout (Body of Water with Assigned Marine Forecast Zone).

St. Louis County									
2E Arnold to French River	**28**	**1651CST 1655CST**	**4.4**	**60**	**0**	**0**			**Tornado (F1)**

A tornado touched down 2 miles east of Arnold. A barn and an outbuilding were destroyed and trees were damaged. The tornado traveled until it reached the shore of Lake Superior at French River where it continued as a waterspout.

LSZ144									
Two Harbors to Duluth MN	**28**	**1655CST 1657CST**			**0**	**0**			**Waterspout**

The St. Louis County tornado event reached the shores of Lake Superior. This waterspout lasted another 2 minutes before dissipating.

7.40.10.5 Examples of a Waterspout (Body of Water with Assigned Marine Forecast Zone) That Became a Tornado.

LMZ645

5NE Wind Pt to Wind Pt WI	**15**	**1700CST 1705CST**			**0**	**1**	**100K**	**Waterspout**

A waterspout developed northeast of Wind Point and moved slowly southwest. Three sail boats about 2 miles offshore were destroyed and one person was injured. The waterspout moved onshore at Wind Point and continued as a tornado in Racine County.

Racine County

Wind Pt to 3SW Wind Pt	**15**	**1705CST 1707CST**	**1**	**25**	**0**	**0**	**200K**	**Tornado (F1)**

A waterspout moved onshore as a tornado at Wind Point. The vortex weakened but still managed to cause significant damage to two piers, a yacht club building, and two small boats. Estimated wind speeds of the tornado were about 65 knots (75 mph).

7.40.11 Segmented and Border-crossing Tornado Entries.

7.40.11.1 Examples of a County/Parish Line-crossing Tornado Within a CWFA. Tornadoes that cross county/parish lines must be entered as segments with one segment per county/parish. *Storm Data* preparers must coordinate entries for tornadoes that cross state lines or CWFAs. Consistency between *Storm Data* entries of border crossing tornadoes is needed to assure an accurate tornado path. Otherwise a single tornado may be misinterpreted as being two separate tornadoes. This can easily occur when external users, not familiar with *Storm Data* practices, use the National Climatic Data Center's (NCDC) Web site query feature. It is critical that all counties/parishes affected by a single tornado, and the exact location that a tornado exits or enters a county/parish, be mentioned in the narrative that discusses that tornado. Do not segment a tornado within a county/parish (an entry for each portion of a tornado that appreciably changes directions). In the example below, the first line of the narrative makes it clear that the tornado moved across a county/parish line, and indicates exactly where the tornado exited the first county/parish.

Coal County

4 SE Coalgate 2.5 ENE Cairo	**11**	**0425CST 0434CST**	**8**	**200**	**1**	**1**	**75K**	**Tornado (F2)**

This tornado formed 4 miles southeast of Coalgate and tracked northeastward for 8 miles before exiting Coal County about 2.5 miles east-northeast of Cairo at 0434 CST. The tornado continued in Atoka County for another 5 miles, before dissipating at 0440 CST. In Coal County, 1 fatality and injuries to another person occurred when a mobile home was thrown approximately 200 yards and disintegrated 4 miles east of Coalgate. In addition, a well-constructed frame home suffered severe roof damage and exterior wall damage in extreme eastern Coal County. While in Coal County it was rated as F2, but in Atoka County it was rated as F0. Average path width in Coal County was 100 yards, while the maximum width was 200 yards. F62MH

Atoka County

1.5 NW Wardville to 5.5 SE Wardville	**11**	**0434CST 0440CST**	**5**	**100**	**0**	**0**	**6K**		**Tornado (F0)**

This tornado formed 4 miles southeast of Coalgate in Coal County and entered Atoka County about 1.5 miles northwest of Wardville at 0434 CST. The tornado then continued for another 5 miles before dissipating 5.5 miles southeast of Wardville at 0440 CST. In Atoka County, minor roof damage was inflicted on a mobile home, and numerous trees were damaged. While in Coal County, it was rated as F2, but in Atoka County it was rated as F0. Average path width in Coal County was 50 yards.

7.40.11.2 Examples of a County/Parish Line-crossing Tornado With Other Embedded Severe Events. Referring to the example below, keep in mind that when entering several individual events into *Storm Data* for a specific episode, if a tornado crosses a county/parish line (multi-segmented) and there are several other events (i.e., hail, thunderstorm winds, etc.) falling between the beginning time of the first segment and the beginning times of subsequent segments of the tornado, these events will be inserted between the tornado segments, breaking up the tornado.

The best way to convey a tornado is a county/parish line crossing, segmented tornado is to combine all segments of the tornado into its own episode. Then clear the screen and enter the remaining events, including those that fell in between the segments of the tornado, as a separate episode. Therefore, when people use the *Storm Data* publication, they will see a nice orderly list of events with no breakup of a multi-segmented tornado (in the CWFA), thus making it easier to find the information that they need (see example below). This is what the episode feature was developed for—to create a more orderly list of events.

A separate narrative will be composed for each tornado. This will minimize the possibility that tornado information is lost in a large narrative. Simply writing a two or three sentence narrative, even for a brief tornado touchdown, will get the information across about that tornado.

Calhoun County

Shepherd to 5 SE Sarepta	**01**	**0047CST 0100CST**	**10**	**200**	**1**	**4**	**800K**		**Tornado (F1)**

A tornado spun up in the western part of Calhoun County in the village of Shepherd and tracked northeast, crossing into Pontotoc County 5 miles southeast of Sarepta. It continued for 15 miles in Pontotoc County. In Calhoun County, one man was killed in Randolph when his mobile home was destroyed. Elsewhere in Randolph, two homes were damaged, and four people were injured by airborne debris. Ten barns were destroyed and two horses were killed. Average path width was 125 yards. M50MH

Pontotoc County

2 SW Robbs to 2 W Sherman	**01**	**0100CST 0125CST**	**15**	**200**	**0**	**0**	**1.5M**	**300K**	**Tornado (F1)**

A tornado spun up in the western part of Calhoun County in the village of Shepherd and tracked northeast, crossing into Pontotoc County 2 miles southwest of Robbs at 0100 CST. It continued for 15 miles to a point about 2 miles west of the city of Sherman. Luckily, there were no fatalities or injuries in Pontotoc County. However, nine homes sustained moderate damage, and one mobile home was destroyed in or near the village of Robbs. In addition, fifteen barns were destroyed, two horses were killed, and several fields of corn were damaged. Average path width was 125 yards.

Pontotoc County

2 W Pontotoc	**01**	**0052CST**	**0**	**0**		**Hail (0.75)**

Pontotoc County

Pontotoc	**01**	**0057CST** **0002CST**	**0**	**0**	**10K**	**Thunderstorm Wind (G50)**

Trees and power lines were blown down. Two vehicles sustained tree damage.

7.40.11.3 Examples of CWFA Boundary-crossing Tornado. WFOs must coordinate the beginning and ending locations of tornadoes that move from one CWFA into another. This will assure that all affected counties/parishes are mentioned. In the following example, both segments mention that the tornado crossed from one county/parish into another one.

TEXAS, North

Cooke County

4 NW Gainesville to 6 N Gainesville	**11**	**0255CST** **0258CST**	**2.6**	**150**	**0**	**0**	**30K**		**Tornado (F1)**

A tornado touched down 4 miles northwest of Gainesville. It then moved into Love County, Oklahoma, 6 miles north of Gainesville (see *Storm Data* for Oklahoma, Western, Central and Southeast). In Cooke County, a mobile home and a storage pole barn were heavily damaged northwest of Gainesville. Average path width for the Texas portion was 75 yards.

OKLAHOMA, Western, Central, and Southeast

Love County

5 S Thackerville to 3 ESE Thackerville	**11**	**0258CST** **0304CST**	**5**	**100**	**0**	**0**	**100K**	**100K**	**Tornado (F1)**

This tornado developed in Cooke County, Texas, about 4 miles northwest of Gainesville, and tracked northeastward before crossing the Red River into Love County in Oklahoma (see *Storm Data* for Texas, North, for more information on the beginning portion of this tornado in Texas) at 0258 CST at a point 5 miles south of Thackerville. In Oklahoma, the most significant damage, rated F1, occurred 3 miles southeast of Thackerville where a barn was destroyed, and some soy bean crop was uprooted. Nearby, a mobile home was severely damaged with debris scattered for 2 miles. Average path width for the Oklahoma portion was 50 yards.

7.40.12 Multiple Tornadoes in One Episode.

7.40.12.1 Examples of Grouping Multiple Tornadoes. In the example below, if there are multiple tornadoes in one severe weather episode, each tornado has its own narrative. In addition, if the tornadoes are not separated by a large time span, they can be entered together as a group in one episode. This will keep them separated from other severe weather events for easier publication reading.

Sevier County
7 SW DeQueen to 23 1557CST 9.7 50 0 0 Tornado (F1)
4 SE DeQueen 1620CST

This tornado occurred over a wooded region with few homes or structures in the area.

Howard County
3 S Mineral Spgs 23 1601CST 3.8 200 0 0 10K Tornado (F0)

Tollette 1609CST

Damage was primarily broken and downed trees with one home suffering minor roof damage.

Hempstead County
DeAnn to 23 1625CST 2.4 200 0 0 22K Tornado (F0)
2.4 NE DeAnn 1629CST

Two homes were damaged by falling trees. One barn lost siding and roofing material. Many trees were toppled or snapped. Average path width was 75 yards.

7.40.13 Fujita Tornado Intensity Scale Table.

F-Scale	Tornado Intensity	Damage Intensity	Wind Speed	Typical Damage
F0	Weak	Gale Tornado	35-63 kts (40-72 mph)	Tree branches broken, chimneys damaged, shallow-rooted trees pushed over; sign boards damaged or destroyed, outbuildings and sheds destroyed.
F1	Weak	Moderate	64-97 kts (73-112 mph)	Roof surfaces peeled off, mobile homes pushed off foundations or overturned, moving autos pushed off the roads, garages may be destroyed.
F2	Strong	Significant	98-136 kts (113-157 mph)	Roofs blown off frame houses; mobile homes demolished and/or destroyed, train boxcars pushed over; large trees snapped or uprooted; airborne debris can cause damage.
F3	Strong	Severe	137-179 kts (158-206 mph)	Roofs and walls torn off well constructed houses; train cars are overturned; large trees are uprooted, can knock down entire forest of trees; heavy cars lifted off the ground and thrown.
F4	Violent	Devastating	180-226 kts (207-260 mph)	Well-constructed frame homes leveled, but debris remains close by; structures with weak foundations blown off some distance; automobiles thrown and disintegrated; large airborne objects can cause significant damage.
F5	Violent	Incredible	227-276 kts (261-318 mph)	Brick, stone, and cinder-block buildings destroyed, most debris is carried away by tornadic winds, large and heavy objects can be hurled in excess of 300 feet, trees debarked, asphalt peeled off of roads, steel reinforced concrete structures badly damaged.

Table 13. Fujita Tornado Intensity Scale.

7.40.14 <u>F-Scale and Structural Damage Relationship and Images</u>.

Damage f scale		Little Damage	Minor Damage	Roof Gone	Walls Collapse	Blown Down	Blown Away
		f0	f1	f2	f3	f4	f5

Windspeed F scale	17 m/s	32	50	70	92	116	142
	F0	F1	F2	F3	F4	F5	
	40 mph	73	113	158	207	261	319

To convert f scale into F scale, add the appropriate number

Weak Outbuilding	-3	f3	f4	f5	f5	f5	f5
Strong Outbuilding	-2	f2	f3	f4	f5	f5	f5
Weak Framehouse	-1	f1	f2	f3	f4	f5	f5
Strong Framehouse	0	F0	F1	F2	F3	F4	F5
Brick Structure	+1	-	f0	f1	f2	f3	f4
Concrete Building	+2	-	-	f0	f1	f2	f3

Fig. 2.4-1 The Fujita tornado scale (F scale) pegged to damage-causing windspeeds. The extent of damage expressed by the damage scale (f scale) varies with both windspeed and the strength of structures.

Table 14. Estimate of F-Scale Wind from Structure Type and Damage Category by Fujita (1989).

Minimum wind speeds: F0 (35 kts/40 mph); F1 (64 kts/73 mph); F2 (98 kts/113 mph); F3 (137 kts/158 mph); F4 (180 kts/207 mph); F5 (227 kts/261 mph).

When entering the narrative to a tornado event, the description should be written remembering that it is a damage scale and the winds listed are estimated. Thus, a tornado does not necessarily “strengthen” as it moves into a town, housing development, subdivision or industrial area. If the tornado increases in speed or widens, then it may be assumed that the tornado physically is strengthening. Because the tornado moves into an area encountering more structures creating more debris does not necessarily indicate a strengthening of the tornado.

Typical F0 Tornado Damage
Note the trees have been stripped of leaves, but the trees remain standing. Only light roof damage with a few missing shingles.

Typical F0 Tornado Damage
A poorly anchored home is pushed off its foundation.

Typical F1 Tornado Damage
Shallow rooted trees are uprooted and shingles are ripped from the roof with significant roof damage.

Typical F1 Tornado Damage
Structural damage can occur to well built structures, as shown in this photograph. The garage wall supports have been pushed in.

Typical F2 Tornado Damage
This home has had the entire roof blown off, yet the exterior walls remain intact. Some of the stronger hardwood trees remain standing.

Typical F2 Tornado Damage
More significant structural damage occurs. Note the severe damage to this home's roof and exterior walls.

Typical F3 Tornado Damage
This home is missing the entire roof as well as some of the exterior walls. Trees are blown over or snapped near the base and outbuildings are destroyed.

Typical F3 Tornado Damage
Most walls of a home can be knocked down. Only an interior wall of this home remains standing.

Typical F4 Tornado Damage
This home is completely obliterated, with no walls left standing. The debris from the home remains at the location where the house once stood.

Typical F4 Tornado Damage
All walls of well-built structures are blown down, including most of those made of brick or stone.

Typical F5 Tornado Damage
These homes have been completely removed from their original locations. The debris field has been scattered some distance from their foundation.

Typical F5 Tornado Damage
Most homes in a wide area are destroyed, leaving only foundations. The debris seen in the foreground is most likely debris from other homes in the area.

Typical F5 Tornado Damage
Debris created by the destroyed house has been scattered from the home site. Only the foundation remains to indicate the structure's original location.

(*Aerial Photographs courtesy of Brian Smith, Meteorologist, National Weather Service, Valley, NE; Ground Photographs courtesy of Tim Marshall, Structural Engineer, Haag Engineering, Dallas, TX)*

7.41 **Tropical Depression (Z).** A tropical cyclone in which the 1-minute sustained wind speed is 33 knots (38 mph), or less. The tropical depression number will be included in the narrative section. The Tropical Depression should be included as an entry if its effects, such as gradient wind, freshwater flooding, and along the coast, storm tide, are experienced within the WFO's CWFA, including its coastal waters. The center of the tropical depression may not actually move ashore. Terrain (elevation) features, in addition to the storm tide/run-up height, will determine how far inland the coastal flooding extends.

The tropical depression will usually include many individual hazards, such as storm tide, freshwater flooding, tornadoes, mudslides, rip currents, etc. Refer to Section 7.24 for additional information that may be applicable for tropical depressions, as well as its associated individual hazards. The Strong Wind event name will be used for wind damage reports from inland counties /parishes that experienced a tropical depression. Wind damage in coastal counties/parishes and islands will be entered as a Tropical Depression event. Refer to Sections 7.24 and 7.38 for details.

Beginning Time - When the direct effects of the tropical depression were first experienced.

Ending Time - When the direct effects of the tropical depression were no longer experienced.

Direct Fatalities/Injuries

- ❏ Casualties caused by storm tide, rough surf, freshwater flooding, or wind-driven debris.
- ❏ Wind caused a tree to blow onto someone.
- ❏ A person drowned while surfing in rough waters.
- ❏ Someone drowned when flood waters swept a vehicle into a river.

Indirect Fatalities/Injuries

- ❏ Someone suffered a heart attack while removing debris.
- ❏ Someone was electrocuted by touching downed power lines.
- ❏ Someone drowned when a vehicle was driven into a canal.

Example:

TXZ183 Val Verde
23 2200CST 0 0 Tropical Depression
1000CST
Tropical Depression Two and its remnants stalled over the Big Bend area and produced up to 18 inches of rain in Del Rio. Winds gusts of 35 knots (40 mph) and minimum sea-level pressure of 1015 mb were reported at Del Rio. The main effect of T.D. #2, namely flash flooding on San Felipe Creek, resulted in 9 fatalities (drowning), 150 injuries, $40.0M in property damage, and around $100K in crop damage.

7.42 **Tropical Storm (Z).** A tropical cyclone in which the 1-minute sustained surface wind ranges from 34 to 63 knots (39 to 73 mph) inclusive. The tropical storm should be included as an entry when its effects, such as wind, storm tide, freshwater flooding, and tornadoes, are experienced in the WFO's CWFA, including the coastal waters. Terrain (elevation) features, in addition to the storm tide/run-up height, will determine how far inland the coastal flooding extends.

The tropical storm will usually include many individual hazards, such as storm tide, freshwater flooding, tornadoes, mudslides, rip currents, etc. Refer to Section 7.24 for additional information that may be applicable for tropical storms, as well as their associated individual hazards. In the western North Pacific and American Samoa, the appropriate Tropical Storm Category (A or B) on the Saffir-Simpson Tropical Cyclone Scale will be annotated (refer to Section 7.24.2 for the Scale).

Note: Tropical cyclone entries in *Storm Data* are based upon the wind speeds observed in the WFO's coastal and marine zones. If a hurricane produces only tropical storm force winds in a particular CWFA, the entry should be made under Tropical Storm. However, such entries must include a reference the hurricane in the narrative section, e.g., "Hurricane Dennis produced tropical storm force winds in ...."

The High Wind event name will be used for wind damage reports from inland counties/ parishes that experienced a tropical storm. Wind damage in coastal counties and islands will be entered as a Tropical Storm event. Refer to Sections 7.23 and 7.24 for details.

Beginning Time - When the direct effects of the tropical storm were first experienced.

Ending Time - When the direct effects of the tropical storm were no longer experienced.

Direct Fatalities/Injuries
- ❏ Casualties caused by storm tide, rough surf, freshwater flooding, or wind-driven debris or structural collapse.
- ❏ Wind caused a tree to blow onto someone.
- ❏ Someone drowned while surfing in rough waters.
- ❏ Someone drowned when flood waters swept a vehicle into a river.

Indirect Fatalities/Injuries
- ❏ Someone suffered a heart attack while removing debris.
- ❏ Someone was electrocuted by touching downed power lines.
- ❏ Someone drowned when a vehicle was driven into a canal.
- ❏ Someone was killed in a vehicle accident caused by a tropical storm-related missing traffic signal.

Example:

FLZ007>019-026>028 Inland Walton - Coastal Walton - Holmes - Washington - Jackson - Bay - Calhoun - Gulf - Franklin - Gadsden - Leon - Jefferson - Madison - Liberty - Taylor - Wakulla

21 1800EST 0 0 1M 100K Tropical Storm
23 0000EST

Tropical Storm Helene made landfall near Fort Walton Beach during the late morning hours of September 22. Storm total rainfall ranged from a half inch at Perry to 9.56 inches at Apalachicola. The highest sustained wind of 39 knots (45 mph) with a peak gust of 56 knots (65 mph) was recorded at Cape San Blas. The lowest sea-level pressure was 1011 mb at Panama City. Coastal storm tides of 2 feet or less above astronomical tide levels were common, with only minor beach erosion reported. Near the coast, as well as inland, many properties, homes, and businesses sustained wind damage. No fatalities or injuries were attributed to the winds. All of the associated effects of Helene resulted in 4 fatalities, 13 injuries, $3.0M in property damage, and around $1.0M in crop damage. Specifically, Helene's flood waters in the Florida Panhandle resulted in 2 fatalities, 3 injuries, $1.0M in property damage, and $750K in crop damage. The nine associated tornadoes resulted in 2 fatalities, 10 injuries, $1M in property damage, and $150K in crop damage. The powerful winds caused $1M in property damage and $100K in crop damage. The storm surge along the coast resulted in $500K in property damage.

7.43 **Tsunami (Z).** A series of very long waves generated by any rapid, large-scale disturbance of the sea (e.g., an underwater earthquake, landslide, or volcanic eruption) resulting in a fatality, injury or damage. When the wave reaches the coast, a tsunami may appear as a rapidly rising or falling tide, a series of breaking waves, or even a bore. The narrative should include the source of the tsunami (e.g., 8.5 earthquake near the western coast of Chile), the height or range of heights observed, and the inland distance of inundation. Any other characteristics, such as the number of waves occurring during the event or the observation of water draining from bays should be included.

Beginning Time - When the water level first began to change rapidly.

Ending Time - When the water level returned to near normal. If a series of waves was noted then report beginning and ending time of each in the narrative.

Direct Fatalities/Injuries
- ❑ A coastal dwelling was washed away injuring or killing the occupants.
- ❑ A person drowned when vehicle was swept away.

Indirect Fatalities/Injuries
- ❑ A person suffered a heart attack while evacuating.
- ❑ After the tsunami, a person died when the house he returned to collapsed.

Example:

HIZ008 **South Hawaii including Kauna Point**
07 0600HST 0 0 5M Tsunami
1000HST
A tsunami wave affected coastal sections of the south and east shores of the Big Island of Hawaii from Hilo Harbor to Kauna Point. The tsunami resulted from an 8.3 earthquake that occurred off the coast of Chile. Tide gauges located on buoys 150 miles SE of the big island of Hawaii reported a 2-inch rise as the tsunami passed. A 20-foot wave at Punaluu Harbor was the highest of three waves that occurred over a 2-hour and 20-minute period. The wave went inland as far as ½ mile. The height of the waves ranged from 5 feet at Hilo Harbor on the east coast to 20 feet at Punaluu Harbor on the southeast coast to 3 feet near Kauna Point on the southwest coast. There were no deaths or injuries, but several marinas were heavily damaged and coastal roads were flooded. These damages amounted to $5.0 M.

7.44 **Volcanic Ash (Z).** Fine particles of mineral matter from a volcanic eruption which can be dispersed long distances by winds aloft, resulting in fatalities, injuries, damage, or a disruption of transportation and/or commerce.

Beginning Time - When volcanic ash began to cause disruption to transportation, commerce, fatality, injury, or damage.

Ending Time - When volcanic ash stopped falling.

Direct Fatalities/Injuries
- ❏ People who were asphyxiated due to high ash content in the air. (Rare)
- ❏ People who were involved in aircraft accidents due to ash being ingested into the engines.

Indirect Fatalities/Injuries
- ❏ Vehicular accidents caused by reduced visibility and slippery roads due to volcanic ash fall, or due to falls while walking through volcanic ash.

Example:

WAZ040 Southern Cascade Foothills
10 1800PST 0 0 Volcanic Ash
2100PST

A minor eruption of Mt. St. Helens caused ash to rise about 10,000 feet into the atmosphere. The ash drifted to the southwest and fell in the southern Cascade foothills. State Highway 503 became slippery when it was covered with ash, which caused a head-on collision of two vehicles. One person was killed (indirect fatality) and the other seriously injured (indirect injury).

7.45 **Waterspout (M).** A rotating column of air, pendant from a convective cloud, with its circulation extending from cloud base to the water surface of an area assigned as a Marine Forecast Zone, including bays, the Great Lakes, Lake Okeechobee, and Lake Pontchartrain. A condensation funnel may or may not be visible in the vortex.

A vortex that moves over both water and land will be characterized as a Waterspout for that portion of its path over the water surface of an assigned Marine Forecast Zone, and a Tornado for its path over the land. A vortex over any water surface not designated as an official marine zone will be entered as a Tornado.

Beginning Time - When a waterspout was first reported to exist.

Ending Time - When a waterspout was last reported to exist.

Direct Fatalities/Injuries
- ❏ A waterspout capsized a small boat, drowning the occupant.
- ❏ A waterspout blew a vehicle off a bridge and the driver drowned.

Indirect Fatalities/Injuries
- ❏ A boater fleeing a waterspout crashed into a breakwater.
- ❏ A boater suffered a heart attack after sighting a waterspout.

Examples:

LMZ654
2 E Port Washington 18 1835CST 0 0 Waterspout

A brief waterspout was spotted over Lake Michigan a couple miles offshore of Port Washington. The distance was estimated.

GMZ053
Craig Key to West end of 7 Mile Bridge FL 10 1200EST 1206EST 0 2 50K Waterspout

A large waterspout from the Florida Straits moved across a marina at Marathon damaging three sail boats and injuring two people.

7.45.1 Example of a Tornado That Became a Waterspout (Body of Water with Assigned Marine Forecast Zone).

St. Louis County
2 E Arnold to 1 S French River 28 1651CST 1655CST 4.4 60 0 0 100K Tornado (F1)

A tornado touched down north of Duluth. A barn and an outbuilding were destroyed and trees were damaged. The tornado reached the shore of Lake Superior just south of French River, and then curved northeast as a waterspout moving toward Two Harbors.

LSZ144
1 S French River to Two Harbors 28 1655CST 1705CST 0 0 Waterspout

This waterspout initially began as a tornado in St. Louis County near Arnold. It crossed over the Lake Superior shoreline just south of the village of French River, and then curved northeast toward Two Harbors. No marine-related damage was noted.

7.45.2 Example of a Waterspout (Body of Water with Assigned Marine Forecast Zone) That Became a Tornado.

Lake County
.5 S Two Harbors to 2N Two Harbors 28 1705CST 1707CST 2.5 25 0 0 250K Tornado (F1)

A waterspout on Lake Superior moved onshore as a tornado just south of Two Harbors. The tornado continued on the ground for about 2.5 miles before dissipating. A small building was destroyed and a cottage damaged near where the tornado came onshore. The tornado damaged four more homes and downed around three dozen trees before finally dissipating. The damage path was no more than 25 yards in width.

7.46 **Wildfire (Z).** Any significant forest fire, grassland fire, rangeland fire, or wildland-urban interface fire which consumes the natural fuels and spreads in response to its environment. Significant here is defined as a wildfire that causes one or more fatalities, one or more injuries, and/or property damage (including equipment damaged in fighting the fire). Professional judgment is used in deciding to include a Wildfire in *Storm Data*. In general, forest fires smaller than 100 acres, grassland or rangeland fires smaller than 300 acres, and wildland use fires not actively managed as wildfires should not be included. This is consistent with the definitions for significant and/or large fires utilized by most land use agencies.

Beginning Time - When a forest fire, grassland fire, rangeland fire, or wildland-urban interface fire became out of control.

Ending Time - When a wildfire became under control.

Direct Fatalities/Injuries

- ❑ A wildfire swept through a campground. Two campers died when their RV was consumed by fire.
- ❑ A man drove into an evacuated area to try to save belongings from a cabin that was threatened by a wildfire. The man died when fire burned the cabin to the ground.
- ❑ People who were asphyxiated due to smoke inhalation.

Indirect Fatalities/Injuries

- ❑ All vehicular accidents caused by reduced visibility due to smoke.

Example:

MTZ005-006 Missoula/Bitterroot Valleys-Bitterroot
06 1500MST 0 0 8M Wildfire
31 1500MST
Dry lightning and strong winds started fires which spread into urban areas of the southern part of the county. Structural damage from fires occurred from August 6-8, but fires raged to the end of the month with a total of 335,356 acres burned. Sixty-four residences and cabins were destroyed, and five were partially destroyed. A total of 164 outbuildings and 87 vehicles were destroyed.

7.47 **Winter Storm (Z).** A winter weather event having more than one predominant hazard (i.e., heavy snow and blowing snow, snow and ice, snow and sleet, sleet and ice, or snow, sleet and ice) meeting or exceeding locally/regionally defined 12 and/or 24 hour warning criteria for at least one of the precipitation elements, on a widespread or localized basis. Normally, a winter storm would pose a threat to life or property.

The *Storm Data* preparer should include in the narrative the time that accumulations began.

As with classification of other events, the preparer must use care in classifying an event as a Winter Storm. For example, if the winter event initially consists of a brief mixture of snow and freezing rain, but changes to sleet for most of its duration, and ends with a brief period of freezing rain, it should be classified as a Sleet event.

Beginning Time - The time when the winter storm first met or exceeded locally or regionally defined warning criteria. The beginning time of the precipitation elements should be included in the narrative.

Ending Time - The time when the precipitation and weather elements of the winter storm ended.

Direct Fatalities/Injuries

- ❑ The weight of snow and ice caused a machine shed roof to collapse, killing a farmer.
- ❑ A vehicle slid into a ditch. The driver attempted to find help and died of exposure.

Indirect Fatalities/Injuries

- ❑ All vehicle-related fatalities or injuries due to poor visibility and/or slippery roads.

Example:

WVZ033>035- McDowell - Mercer - Monroe - Raleigh - Summers - Wyoming
042>044 01 1800EST 0 0 Winter Storm
02 1800EST
The new year started off with a major winter storm. A combination of snow, sleet, and freezing rain began around 1500 EST and eventually left about 4 inches of frozen precipitation on the ground across the area. Transportation came to a stop for much of the holiday weekend.

7.48 **Winter Weather (Z).** An accumulation of freezing rain or drizzle, sleet, or snow, less than locally/regionally defined warning criteria, on a widespread or localized basis. Normally, this would result in impact on commerce or transportation. Elements may occur singly or in combination. Examples may include:

a. Blowing and drifting snow;

b. Snowfall that does not meet local warning values, but which may result in severe inconveniences or impact on commerce or transportation; or

c. An extended period of freezing drizzle, not reaching established warning values that may result in power outages or impact commerce or transportation.

In *Storm Data*, no blizzard event should cover a time period of less than 3 hours. Therefore, if blizzard-like conditions occur for less than 3 hours, the event should be entered as Winter Storm, Heavy Snow, or Winter Weather, noting in the narrative that near-blizzard or blizzard-like conditions were observed at the height of the storm.

The *Storm Data* preparer should include in the narrative the time that accumulations began.

The *Storm Data* preparer must use judgment in determining when a winter weather event is significant enough to enter into *Storm Data*.

Beginning Time - When winter weather began to cause significant impact on commerce or transportation.

Ending Time - When the winter weather no longer posed a significant impact.

Direct Fatalities/Injuries

- ❏ A vehicle accident where the driver suddenly encountered an intense snow squall, heavy freezing rain or sleet that was unavoidable. (Rare)

Indirect Fatalities/Injuries

- ❏ Almost all vehicle-related fatalities/injuries due to ice covered roads, hazardous driving conditions, and visibility restrictions.
- ❏ Any vehicle accident involving a snow plow.

Examples:

MAZ001>004 Berkshire - Western Franklin - Eastern Franklin - Northern Worcester
06 0500EST 0 0 Winter Weather
1900EST
A period of freezing drizzle and freezing rain led to a thin layer of ice or glaze over northwest Massachusetts. There were numerous car accidents with minor injuries (indirect) due to the icy conditions, especially along Highways 2 and 202.

SCZ047>049 Jasper - Beaufort - Southern Colleton
01 1800EST 0 0 Winter Weather
2200EST
A mixture of freezing rain, sleet, and snow brought hazardous travel conditions to sections of southern South Carolina. While ice accumulation was small, less than 1/8 inch, the combination of elements led to numerous school closings and accidents, especially along Interstate 95.

NDZ014-015 Benson - Ramsey
12 2200CST 0 0 Winter Weather
13 0300CST
A strong low pressure area and fresh snow led to a round of blowing snow that lowered visibilities to 1/4 to ½ mile at times overnight. Several cars were stranded along County Road 5 in Benson County.

KYZ004-005 Ballard - McCracken
16 1300CST 0 0 Winter Weather
2200CST
An extended period of sleet fell across extreme western Kentucky which led to numerous car accidents and some glazing. The worst conditions were around Paducah where slick streets led to multi-car accidents and the closing of some highways around town.

PAZ001-002 Northern Erie - Southern Erie

25 1400EST 0 0 Winter Weather
2000EST

A period of snow, totaling 4 to 5 inches, led to numerous accidents and minor injuries (indirect) across Erie County in northwest Pennsylvania. Fairfield reported 5 inches. Two school buses collided on a snow covered hill just east of town. Wind speeds were in the 9 to 17 knots (10 to 20 mph) range; consequently blowing snow was minor or non-existent.

APPENDIX A - Glossary of Terms

County Warning and Forecast Area (CWFA) - The geographical area of responsibility assigned to a WFO for providing warnings, forecasts, and other weather information.

Fujita-Scale - A 0 to 5 rating based on a tornado's intensity, indirectly related to observed damage. Since structural design determines damage, probable wind speeds are associated with each F-scale number.

Header Strip - A bold-faced line of text at the beginning of each *Storm Data* entry, providing specific information on the time and character of the weather event. This includes location, beginning and ending times, deaths, injuries, property damage, and type of event. In some cases, it also includes the Universal Geographic Code and the magnitude of the event, i.e., hail size and tornado F-scale.

Saffir/Simpson Hurricane Scale - A 1 to 5 rating based on a hurricane's intensity. This scale designates sustained wind speeds and estimates potential property damage. It sometimes provides estimated associated storm surge.

Saffir/Simpson Tropical Cyclone Scale - A rating scale based on the intensity of a tropical cyclone. This scale has two tropical storm categories and 5 typhoon/cyclone categories, and is used in the western Pacific and other tropical areas. The scale designates sustained wind speeds and corresponding wind gusts, estimated storm surge, and potential property damage.

StormDat - The Paradox-based computer software program documents specifics and narratives of significant weather events. StormDat transfers data from WFOs to the Performance Branch in OCWWS for use in the NWS verification program and to the NCDC for publication of *Storm Data*.

Storm Data - NOAA's official publication which documents the occurrence of storms and other significant natural hazards having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce.